OFFICE OF STATEWIDE HEALTH PLANNING AND DEVELOPMENT
FACILITIES DEVELOPMENT DIVISION
1600 9th Street, Room 420
Sacramento, California 95814
(916) 654-3362 FAX (916) 654-2973

EVALUATION OF THE 2003 MODEL CODES FINAL REPORT

BACKGROUND

OSHPD Authority

The Office of Statewide Health Planning and Development (OSHPD) is the adopting and enforcing agency for the California Building Standards Code, Title 24, California Code of Regulations (CCR), with application to Hospitals, Skilled Nursing Facilities, Correctional Treatment Facilities, and Licensed Clinics. OSHPD has the authority to amend the adopted model building code as necessary to achieve the performance objectives defined in the Alfred E. Alquist Hospital Facilities Seismic Safety Act. The act reads in part:

> It is the intent of the Legislature that hospital buildings that house patients who have less than the capacity of normally healthy persons to protect themselves, and that must be reasonably capable of providing services to the public after a disaster, shall be designed and constructed to resist, insofar as practical, the forces generated by earthquakes, gravity, and winds. In order to accomplish this purpose, the office shall propose proper building standards for earthquake resistance based upon current knowledge, and provide an independent review of the design and construction of hospital buildings. (§129680(a)).

OSHPD also promulgates administrative code provisions within Part 1, Title 24, CCR pertaining to enforcement of building standards.

California Building Standards Law (Health and Safety Code §18929.1) requires that OSHPD and other state agencies meet specific criteria when proposing the adoption, amendment, or repeal of provisions in the California Building Standards Code. This requirement includes consideration of the "Nine-Point Criteria." Included in these criteria are restrictions on adoption of building standards that are in any way ambiguous or vague, in whole or in part. In addition, increase in cost to the public must be reasonably based on overall benefit to be derived from the building standards. In arriving at our selection of a model building code, OSHPD has accorded special consideration to these two criteria.

Overview

The purpose of the building code is to provide for public safety, through an efficient and consistent set of rules for construction. The building code is not a design manual or a construction guide. Vague or contradictory language, rather than providing flexibility, in fact causes confusion and delays, as designers, contractors and building officials struggle to determine the meaning and intent of the code. In adopting a model code,

the enforcing agency reviews and coordinates the code, amending it as necessary to meet its statutory requirements and eliminate conflicts and ambiguities.

OSHPD has evaluated the 2003 *NFPA 5000 Building Construction and Safety Code (NFPA 5000)*, published by the National Fire Protection Association (NFPA), and the 2003 *International Building Code (IBC),* published by the International Code Council (ICC), for adoption as the base document for 2004 *California Building Code (CBC)*. As part of the evaluation, OSHPD considered the structural and non-structural aspects of design and construction, as well as architectural and fire & life-safety provisions that affect structures regulated by OSHPD.

OSHPD has used a three-phase approach to our evaluation.

1. We have reviewed the level of safety provided by the model codes:
   - Compared to the current level of safety provided by the 2001 *CBC*, and
   - Compared to each other.

2. We have evaluated the amount of work needed to amend the codes as required for the design and review of health care facilities, considering:
   - The amendments needed to maintain the current level of safety,
   - The ease with which necessary amendments can be made, both through the model code development process and through California amendments,
   - The use of referenced standards and publications, and the methods for resolving conflicts between referenced standards and the code, and the methods for resolving conflicts between different referenced standards and publications,
   - The amount of work required to review and update Policy Intent Notices (PINs), Code Application Notices (CANs) and other documents.

3. We have evaluated the ease of use of the two model codes from both a design perspective and from a plan review/construction inspection point of view, including:
   - Consideration of the effort that will be required by OSHPD staff and local building officials to understand and enforce the code (local building departments are responsible for enforcement of licensed clinic regulations that OSHPD promulgates). This includes training needed to become proficient in the use of the code, in order to assure correct interpretation and to minimize the impact on plan review turnaround times,
   - Review of the types of support programs offered by ICC and NFPA,
   - Review the clarity and ease of use of the code for architects, engineers and other professionals involved in health care facility construction.

Evaluation Process

To perform our evaluation, OSHPD staff has:

- Performed a comprehensive comparative review of the model codes and the 2001 *CBC*. One aspect of this review where we placed special emphasis is the

structural chapters. In order to perform as detailed a review as possible within our current budget and staffing constraints, and taking advantage of the fact that the structural provisions of the *CBC* adopted by OSHPD and the Division of the State Architect (DSA) are nearly identical, our detailed review of the structural chapters was performed in cooperation with the DSA. A summary of the findings of our comparative review of the structural chapters may be found in Attachment D.

- Participated in the State Fire Marshal's "Operation Code Comparison," and utilized this comparison in our evaluation of the fire and life safety provisions of the proposed model codes affecting buildings under our jurisdiction.
- Attended training presented by NFPA and the International Code Council (ICC).
- Reviewed code evaluation criteria suggested by interested parties.
- Attended public meetings held under the auspices of the California Building Standards Commission, State Fire Marshal and Division of the State Architect to hear testimony of interested parties.
- Requested clarification on different aspects of the model codes from both NFPA and ICC. The questions posed to the model code organizations and their responses are found in Attachment A (NFPA) and Attachment B (ICC).
- Reviewed code comparisons, summaries, and recommendations presented by individuals and professional organizations.
- Prepared this Final Report, detailing our findings and conclusions.

A copy of the presentation made before the California Building Standards Commission on July 16, 2003, is included in Attachment C.

OSHPD Review Team

OSHPD technical staff participated in the review of the model code documents through various state and local organizations, including the NFPA, ICC, ICBO, American Society of Civil Engineers (ASCE), Building Seismic Safety Council (BSSC), National Earthquake Hazard Reduction Program (NEHRP), the Structural Engineers Association of California (SEAOC) and the California State Fire Marshal. A listing of OSHPD staff who participated in the review, and their relevant affiliations are summarized below:

- Susan Botelho – Staff Services Manager III
  - Chief, Regulations Development Section
  - Past President, California Capitol Chapter, ICBO
- Byron "BJ" Foster – Fire/Life Safety Officer
  - Member, NFPA 5000 Height and Area Committee
- Tom Hale – Senior Structural Engineer
  - Co-chair of the SEAOC Central Seismology Committee
  - Past-chair of the State SEAOC Seismology Committee
  - Member of the BSSC/NEHRP 2003 Provisions Technical Subcommittees TS-3 Foundations and Geotechnical Considerations, and TS-12 Base Isolation and Energy Dissipation

- Don Harris – Senior Architect
    - Member, NFPA 5000 Committee on Health Care Occupancies
    - Member, Code 2000 Partnership Egress Working Group
    - Member, OSFM Code Comparison Committee
- John Gillengerten – Senior Structural Engineer
    - Member, Provisions Update Committee (PUC), BSSC/NEHRP Provisions 1994-present
    - Chairman of the BSSC/NEHRP Provisions Technical Subcommittee TS-8, Nonstructural Components and Systems, 1997-present
    - Member, ASCE 7 Task Committee on Earthquake Loads, 1998-present
    - Member, BSSC Code Resource Structural Committee (CRSC), 1997-present
    - Member, NFPA 5000 Committee on Structures and Construction
- Bill Staehlin – Supervising Structural Engineer
    - Current President, SEAOC
    - Past President, Structural Engineers Association of Central California (SEAOCC)
    - Member, ASCE 7 Task Committee on Earthquake Loads, 1998-present
    - ASHRAE member and Past Chair of ASHRAE TC2.7 Seismic Restraint Design
    - Member of the BSSC/NEHRP Provisions Technical Subcommittee TS-8, Nonstructural Components and Systems, 1998-present
- Chris Tokas – SB 1953 Program Manager
    - Past President, SEAOCC
    - Member, ASCE 7 Task Committee on Earthquake Loads
    - Past Chair, SEAOCC Seismology Committee
    - Chair, SEAOC Seismology Committee, 2001 to present
    - Member, International Building Code Structural Committee, 1998 - 2002

Limitations of Evaluation

The task of evaluating two new code sets for adoption is monumental. In order to reduce the task to a manageable size, given the time and staff constraints, the scope of our evaluation was limited, and a number of assumptions were made:

- OSHPD's evaluation is limited to those portions of the Building Code promulgated or enforced by OSHPD. This includes fire and life safety provisions adopted by the State Fire Marshal and enforced by OSHPD.
- Our review was qualitative in nature. Not every potential conflict and problem (or remedy) is covered in this evaluation.
- We performed a cursory review of the Fire Codes. The Building Code provides the minimum standards for building construction. The Fire Code is essentially a maintenance code, used after construction is complete to regulate the use and occupancy of the building. We strongly suggest that the Building and Fire codes that are adopted by California should be from the same "family," since coordination of these two documents is critical.

- We performed a review of the mechanical and plumbing codes. OSHPD proposes that the *Uniform Mechanical Code* and *Uniform Plumbing Code* published by the International Association of Plumbing and Mechanical Officials (IAPMO) should remain the codes adopted by California.
- We did not specifically review the electrical code. The *National Electrical Code* published by NFPA should remain the electrical code adopted by California.

EVALUATION

ARCHITECTURAL AND FIRE AND LIFE SAFETY PROVISIONS

In examining the level of safety provided by the proposed model codes compared to the current *CBC*, both the *IBC* and *NFPA 5000* offer substantially reduced levels of protection than are currently enjoyed under the *CBC*. This reduction is primarily due to tradeoffs in the *IBC* and *NFPA 5000* for fire sprinklers, and increased allowable heights and areas in these codes.

Another major reduction in the level of protection for hospitals and skilled nursing facilities in both the *IBC* and *NFPA 5000,* compared to the CBC, is the allowance of non-fire-rated corridors in hospitals and skilled nursing facilities protected with fire sprinklers. However, *NFPA 5000* goes even farther in Section 19.3.6.1(1), allowing spaces of unlimited area to be open to the corridor, provided they are not used for patient sleeping rooms, treatment rooms or hazardous areas. This would allow hospitals with virtually no walls, except for a few specific types of rooms and smoke barrier walls.

Another significant difference that will affect buildings under OSHPD's jurisdiction is that *NFPA 5000* treats ambulatory healthcare occupancies (clinics) as business occupancies with regard to height and area. This allows surgical clinics in buildings that are much larger and taller than the current *CBC* allows, and even larger than the *IBC* would allow.

OSHPD staff participated in "Operation Code Comparison," the detailed fire and life safety review and analysis of the codes organized by the State Fire Marshal. Our review of the model codes was supplemented with portions of this document that pertain to buildings under OSHPD's jurisdiction. It appears from the data provided in "Operation Code Comparison" that in most areas, both *IBC* and *NFPA 5000* offer lower levels of protection than are currently enjoyed with the *CBC*. Also, the *IBC* and *NFPA 5000* provide roughly equivalent levels of fire and life safety in most areas, compared to each other. In the majority of areas where the two codes differ, a higher level of protection is provided by the *IBC*.

A Blended Family of Codes

While there has been considerable discussion regarding adopting a single "family of codes," this concept may have limited practical value. OSHPD has proposed the adoption of the International Building Code IBC) and International Fire Code (IFC). We

have also proposed adopting NFPA 70, the National Electrical Code (NEC), and the Uniform Plumbing Code (UPC) and Uniform Mechanical Code (UMC), published by IAPMO and part of NFPA's C3 code set. The state has always used the NEC, UPC and UMC, and the coordination issues between these and the building code are relatively few and minor. There are much greater coordination issues when Building and Fire codes from different organizations are chosen. OSHPD has not have reviewed the International Residential Code (IRC), since it does not affect buildings under our jurisdiction.

Building and Fire Codes

Some individuals have suggested that it might be possible to use the building code from one code organization and the fire code from the other. The building and fire codes are clearly the two codes that must be from a single code set. The Building Code contains regulations for how to construct a building, and the Fire Code provides regulations for how to maintain the building once construction is complete. They are designed and written to work together as a unit. Both fire codes extract large portions of text directly from the corresponding building code. (In the case of *NFPA 1/UFC*, much of the text is actually extracted from *NFPA 101 Life Safety Code*, which forms the basis of much of *NFPA 5000*.)

The Building and Fire Codes from the same organization share a common philosophy and organizational structure. Definitions and technical requirements are standardized. Occupancy classifications, types of construction, means of egress, fire protection and suppression systems, and many other elements are all coordinated. None of these is true when building and fire codes from different organizations are mixed, and neither code can function as it was intended, if it can function at all. The task of amending the codes so that they can function together is nearly insurmountable at the state level, and the codes would remain completely dysfunctional and unusable by local jurisdictions.

It has been pointed out that the work of the Code 2000 Partnership was stopped because the task of identifying and resolving the conflicts between the Building and Fire codes was too great a task to complete in the time available. The codes under consideration at that time were the *International Building Code* and the *Uniform Fire Code*. These documents are both part of, or directly descended from, the Uniform code set. They are much more similar in format and content than the *International Building Code* and *NFPA 1/UFC,* so it can be inferred that the difficulties in coordination will be proportionately greater if codes from different organizations are selected.

Mechanical, Plumbing and Electrical Codes

Some have also mistakenly stated that there were too many conflicts between the Building Code and the Mechanical, Plumbing and Electrical Codes to resolve during the Code 2000 Partnership. This is not the case. Conflicts between these codes were easily identifiable, and amendments to resolve these conflicts fairly easy to implement. In fact, the state has adopted and used the Uniform Mechanical Code, Uniform Plumbing Code and National Electrical Code for decades, even though they are

produced and published by different organizations with differing affiliations. There is no reason to believe that there will be any greater difficulty in using these codes as part of the 2004 California Building Standards Code.

NFPA 5000 and the *International Residential Code*

A significant number of buildings under OSHPD jurisdiction are designed using conventional wood frame construction. It has been suggested that adopting the *IRC* with *NFPA 5000* would solve the problems that have been identified with the wood chapters in *NFPA 5000*. However, the *IRC* is very narrowly scoped, and only applies to one- and two-family dwellings and townhouses, not more than three stories in height. Other occupancies, such as skilled nursing facilities, and taller structures cannot be reviewed using the *IRC*, and would therefore fall under the scope of *NFPA 5000*. Our discussion of NFPA's wood chapter demonstrates that this is not a workable solution.

NFPA 1/Uniform Fire Code v. International Fire Code

Most of the requirements in the Fire Codes are dedicated to the maintenance and protection of existing structures. OSHPD has reviewed those portions of the Fire Codes that pertain to building construction. Based on our review, and our evaluation of the State Fire Marshal's "Operation Code Comparison" document, the *IFC* and *NFPA 1/UFC* appear to provide nearly equal levels of protection in most areas, and both are fairly well coordinated with their companion building codes. Some exceptions to this are explained in detail below. The *IFC* contains many sections that are extracted directly from the *IBC*. *NFPA 1/UFC* does not refer to *NFPA 5000*, but rather to many other NFPA documents. Many sections are extracted directly from *NFPA 101 Life Safety Code*. Based on our comparative review of the *IFC* and *NFPA 1/UFC*, we find the *IFC* to be better coordinated, and references to the corresponding Building Code more direct and clear.

Coordination Issues with *NFPA 5000*

NFPA representatives have testified before the Commission and other bodies, and stated in their correspondence that the NFPA documents are "automatically coordinated" with each other. While this assertion may raise questions about the specific aspects of "automatic" coordination, the NFPA codes indicate there are serious flaws in the coordination process.

For example, *NFPA 1/UFC*, Section 12.7.3.1 states, "Wall openings required to have a fire protection rating by the table in 12.7.3.1 shall be protected by approved… assemblies…" No table is located in the referenced section, nor is any table located on that page of the code.

Another example can be found in the requirements for the protection of penetrations in smoke barrier walls and fire barrier walls. Similar requirements are found in three separate NFPA documents: *NFPA* 5000, *NFPA 1/UFC*, and *NFPA 101*. The differences in the text (shown below in boldface type) are subtle, but the effect is quite substantial.

NFPA 5000, Section 8.11.5.3 reads:

> "Where a smoke barrier is also constructed as a fire barrier, the penetrations shall be protected in accordance with the requirements of Section 8.8 to limit the spread of fire for a time period equal to the fire resistance rating of the assembly as required by 8.11.5 to restrict the transfer of smoke."

This section refers to Section 8.8, governing the protection of penetrations in fire walls, fire barrier walls, and fire resistance-rated horizontal assemblies, which appears to be an appropriate reference. The last portion of the sentence, however, makes no sense. It seems to indicate that the time period for fire resistance of the assembly is found in the section to restrict the transfer of smoke. The text of the section obviously does not convey the desired intent, nor is it possible to determine what the intent should be from the text.

NFPA 1/UFC, Section 12.9.6.3 is similar, but the last half of the section has been rewritten:

> "Where a smoke barrier is also constructed as a fire barrier, the penetrations shall be protected in accordance with the requirements of Section **8.4 of *NFPA 101*** to limit the spread of fire for a time period equal to the fire resistance rating of the assembly **and 12.9.6 to resist the transfer of smoke, unless the requirements of 12.9.6.4 are met. [*101*:8.5.5.3]**"

In *NFPA 1/UFC*, the last portion of the section, which deals with the spread of smoke, is clarified, and a very limited exception is added for fire sprinkler piping. However, *NFPA 1/UFC* refers to Section 8.4 of *NFPA 101* for requirements for the spread of fire. This section is titled "Smoke Partitions," and contains no requirements for the spread of fire, since smoke partitions are not required to have a fire resistance rating. This appears to be an incorrect reference.

Since the *Fire Code* refers to *NFPA 101, Life Safety Code*, we checked the corresponding section here as well. The text of *NFPA 101*, Section 8.5.5.3 is nearly identical to the *Fire Code*, but refers to a different section for requirements to limit the spread of fire.

> "Where a smoke barrier is also constructed as a fire barrier, the penetrations shall be protected in accordance with the requirements of **8.3.5** to limit the spread of fire for a time period equal to the fire resistance rating of the assembly and **8.5.5 to resist the transfer of smoke, unless the requirements of 12.9.6.4 are met.**"

This section in *NFPA 101, Life Safety Code* contains what is perhaps the correct version of these requirements. Code references for both the spread of fire and the transfer of smoke are to sections that contain applicable requirements.

A separate but related issue is addressed in this section. *NFPA 1,* Section 12.9.6.4 allows the space around a sprinkler pipe that penetrates a single membrane of a fire rated wall to be protected with a non-combustible escutcheon plate if the space around the pipe does not exceed ½ inch. However, *NFPA 13*, which regulates the installation of fire sprinkler systems, contains no such exception. *NFPA 13*, Section 6-4.4 indicates that the hole through the wall must be at least two inches larger than the pipe, and this space must be filled with flexible material "where required," presumably in fire rated walls. No clearance is needed between sprinkler pipe and gypsum board if the wall is not required to have a fire rating.

A set of codes that are "automatically coordinated" should have requirements and exceptions that are similar from one document to another. This does not appear to be the case with the NFPA documents we reviewed. We did not find any similar lapses in coordination in the IFC.

STRUCTURAL PROVISIONS

General

The 2001 *CBC* encompasses over half a century of incremental improvements in the *Uniform Building Code (UBC)*. The *UBC* and *CBC* provisions have been developed in response to unique regional conditions, including California's high level of seismic activity. In contrast, both the *IBC* and *NFPA 5000* codes represent efforts to develop a single code to be used throughout the nation. As such, they differ significantly from the 2001 *CBC*, in some areas being more conservative, in others less.

The structural provisions of *IBC* and *NFPA 5000* follow a developing trend that began with the 1997 *UBC*. In the 1997 *UBC*, the National Earthquake Hazard Reduction Program *Recommended Provisions for Seismic Regulations for New Buildings* (*NEHRP Provisions*) became the technical basis for the seismic design provisions of the *UBC*, replacing the recommended seismic provisions promulgated by the Structural Engineers Association of California.

The seismic design methodology, upon which both the *IBC* and *NFPA 5000* are based, is dramatically different from that in the 2001 *CBC*. The concept of seismic zones, which divided the state into two levels of risk, has been replaced with contour maps showing expected ground shaking intensity. Since all of California was classified in seismic zones 3 or 4 (the areas of highest risk), building systems like unreinforced masonry (URM), which have historically performed very poorly in earthquakes, were prohibited.

As a result of the new seismic hazard mapping approach used in the *IBC* and *NFPA 5000*, earthquake design lateral force levels now vary dramatically from one part of the state to another. In the 2001 *CBC*, the difference between design force levels between regions of highest and lowest seismic activity in California was a factor of 2. Under either proposed code, the difference will be a factor of 8 to 10. The proposed codes will allow the reintroduction of low ductility structural systems (such as unreinforced

concrete and URM), which have not been permitted in California for 70 years. We believe that this is an unintended consequence of the change in seismic design procedures, reflected by the fact that there are currently code change proposals under consideration for the 2003 edition of the *NEHRP Provisions* that will restrict the use of the low ductility systems in areas of moderate seismicity nationwide, including areas of California. However, even if these proposals are successful at the national level, it will be at least 3 years before the changes are reflected in *ASCE 7-05 Minimum Design Loads for Buildings and Other Structures* (2005 edition), the primary source document for seismic design used by both model codes. In the interim, state and local enforcement agencies will have to amend the code to restrict the use of these low-ductility building systems.

The practice of tying seismic detailing and design requirements to seismic zone has been abandoned. Seismic design requirements are now tied directly to the type of lateral force resisting system in the building. For example, the design and detailing requirements of a steel special moment frame building are the same whether the building is constructed in Los Angeles or Oklahoma City.

The use of certain structural systems is limited by the Seismic Design Category (SDC) of the building. SDC is a function of ground shaking potential and occupancy. All buildings in the same SDC are subject to the same general requirements. For example, the structural system of a hospital in Sacramento (Seismic Design Category D) will be designed to the same seismic requirements as a grocery store in San Diego (also Seismic Design Category D).

Therefore, regardless of which model code is chosen, significant amendments to the structural provisions of the code will be needed if the current level of safety in the 2001 *CBC* is to be maintained.

Reference Standards and Publications

Both *IBC* and *NFPA 5000* use referenced standards to cover some aspects of structural design and building construction, rather than include the text of the design requirements directly in the code. This is a departure from the 2001 *CBC*, where most of the requirements for design were contained directly in the code, and any amendments are clearly shown in the context of the code language. Many of the structural design provisions have been replaced, in whole or in part, by references to *ASCE 7-02, Minimum Design Loads for Buildings and Other Structures. IBC* relies on referenced standards for steel and concrete design, and some aspects of masonry design. In *NFPA 5000*, reliance on referenced publications is almost complete for all materials.

Numerous conflicts and inconsistencies exist in reference standards, which arise from a number causes, not the least of which is the fact that update and development cycles of the various referenced documents are not coordinated. The writers of the various standards attempt to coordinate their provisions with other standards, but this effort is not always successful. Additionally, referenced standards are routinely amended at the

national level, in the NEHRP *Provisions* and *ASCE 7*. These amendments correct many of the deficiencies in the referenced standards, but many others remain.

Resolving Conflicts Between Referenced Documents

In order for a building code to be easily usable and enforceable, the inconsistencies and conflicts between referenced standards must be resolved. To accomplish this, the model code organizations must have an efficient mechanism in place to resolve conflicts between referenced documents. If they are not resolved by the model code promulgating organization, then the adopting agency must use its resources to resolve conflicts. We asked questions of both model code organizations regarding the resolution of conflicts, with two objectives: first, to determine what mechanisms are used by the organization to deal with conflicting reference documents in the code development process and second, to determine how the apparent conflict can be resolved in the context of the code as written. The relationship between the code and the referenced documents, and the manner in which conflicts between referenced documents are resolved, appears to be fundamentally different in the *IBC* and *NFPA 5000*.

The seismic design provisions of *ASCE 7-02* provide an illustration of the differences between the two model codes, and the importance of this issue. *ASCE 7-02* refers to specific sections in specific editions of the materials standards for steel, concrete, and masonry design. Without these specific references, the seismic design provisions of *ASCE 7-02* are not readily usable. Different editions of the same standards are not interchangeable. A conflict exists when the model code makes reference to a specific edition of a material standard (for example, the 2002 edition of the masonry design standard), and *ASCE-7-02* refers to a different edition of the same referenced standard (for example, the 1999 edition of the masonry design standard).

In the *IBC*, secondary standards that are cited within a referenced standard are considered part of the code (Attachment B, Question 7). In addition, *IBC* materials chapters are relatively complete, and reference specific sections in reference standards, rather than the entire standard. This permits easier coordination between standards, since conflicting provisions are simply not included in the reference. For example, *ASCE 7-02,* Section A9.11, contains references to the masonry design standard *ACI 530-99*, which conflict with the provisions of *ACI 530-02*. However, *IBC* does not adopt *ASCE 7-02*, Section A9.11. Instead, *IBC* Chapter 21 contains a complete set of seismic design regulations for masonry that are coordinated with the appropriate portions of *ACI 530-02*.

In contrast, NFPA has given two different answers to the issue of secondary standards. The first states that in general, secondary and tertiary referenced documents are not considered part of the NFPA code. This renders *ASCE 7-02* unusable without substantial amendment, since the materials standards referenced therein, which are vital to the use of the document, are not valid references. Further, NFPA shifts the burden of sorting out the enforceability of secondary and tertiary references onto the

building official (Attachment A, response to Structural Question 6, page 17 of 22). NFPA, speaking of conflicts between the different editions of the masonry design codes, states "…as part of the review process, California will want to compare the seismic provisions of *ACI 530-99* with *ASCE 7-02*'s modifications to those of *ACI 530-02* to determine if there are conflicts and how best to deal with those conflicts." In the NFPA response to the OSHPD Preliminary Report, NFPA reverses this position, stating that secondary and tertiary references are enforceable. Even if this is the case, it does not resolve the issue raised in this example, since Section 43.2 of *NFPA 5000* refers specifically to *ACI 530-02*. *NFPA 5000* Section 1.3.2 states that where the requirements of a referenced code or standard differ from NFPA 5000, the requirements in NFPA 5000 shall govern. Therefore, it would be a violation of the NFPA code to substitute *ACI 530-99* (the edition referenced in *ASCE 7-02*) for *ACI 530-02*. As a result, of the 11 specific section references in *ASCE 7-02* to sections in *ACI 530-02*, 4 are correct, 2 refer to incorrect sections in *ACI 530-02*, and 5 refer to sections that do not exist.

If the writers of the standard or the model code promulgating organization do not resolve conflicts, then the adopting agency must use its resources to resolve conflicts. The process of identifying and then resolving these types of conflicts will require a significant staff effort and a large number of California amendments. The problem is acute with *NFPA 5000*, since that code relies almost entirely on referenced publications, many of which are not written in concise or enforceable language. While there are also potential conflicts in the *IBC*, ICC has taken a position on precedence that provides a framework to resolve conflicts.

In general, it is significantly more difficult to amend and use codes that make heavy use of referenced standards. The user must jump from standard to standard during the course of design or review. In addition, amended referenced standards can be difficult to use, because the code contains only the amendment, and the text of the referenced standard is generally not reproduced in the code. Hence, the user must first be aware that the standard has been amended, and then put the amendment into the proper context. The likelihood of errors is greatly increased. *NFPA 5000*, with its' complete reliance on referenced publications, will be more difficult to amend and use. The *IBC* will also be easier to use due to the fact that some of the text of the referenced standards is repeated in the model code.

Another difficulty arises from the fact that while *IBC* limits itself to the use of reference standards, *NFPA 5000* uses a broader group of documents, which are referred to as reference publications. The distinction is important. Referenced standards are likely to be written in concise, enforceable language. In contrast, the referenced publications in NFPA include a significant number of guidelines and manuals. Although *NFPA 5000,* Section 2.1 specifically states that these documents are part of the requirements of the code, the guidelines and manuals are typically written using language that is neither concise nor enforceable.

Amendment of Referenced Standards
Another fundamental difference between the ICC and NFPA deals with their approach to amending referenced standards during the model code development process. The *IBC* routinely amends referenced standards to eliminate conflicts or to meet performance objectives of the code (for example, see Chapters 19 and 21 of the 2003 *IBC*). While conflicts still exist in the *IBC*, there is a mechanism for resolving conflicts between referenced standards when they are identified in the code development process.

In contrast, NFPA technical committees may take one of several approaches in response to the conflict (Attachment A, Structural Questions 3b, page 15 of 22; Question 5, page 16 of 22): they may decide to accept the "differences" (i.e. accept conflicting provisions), they may adjust criteria in *NFPA 5000* not to conflict (i.e. amend *NFPA 5000*), or they may submit a proposed change to the referenced publication in its' next revision cycle (i.e. accept conflicting provisions, but attempt to get the "owners" of the referenced publications to resolve the difficulty). The first approach builds a conflict into the code. The second approach, (where the conflict is resolved in *NFPA 5000*) appears to have been rarely employed in the structural chapters. The third approach could take years to resolve, and even then the publisher of the referenced document may choose not to make the change. As noted above, this leaves the task of identifying and correcting conflicts in the referenced standards to California (Attachment A, response to Structural Question 6 sub-bullet, page 18 of 22).

Compared to the *IBC*, it will take significantly more effort to amend the structural provisions of the *NFPA 5000* code to eliminate apparent conflicts between the code and referenced standards and provide a level of safety equivalent to that found in the 2001 *CBC*.

Materials Standards
Both *NFPA 5000* and *IBC* reference documents that potentially conflict with the requirements of *ASCE 7-02*.

IBC
In the case of the *IBC*, this includes the 2002 editions of three standards: the masonry design standard, *ACI 530-02*; the concrete design standard *ACI 318-02;* and the steel design standard, *AISC 341-02*. *ASCE 7-02* references and amends the 1999 editions of all three standards. The conflicts will require coordination efforts on the part of the enforcing agency.

The coordination effort required for the concrete and steel chapters (Chapters 19 and 22) of the *IBC* appears manageable, since the technical changes in the standards were minor, and the new editions are organized such that cross referencing is still relatively straight forward.

Chapter 21 of the *IBC* contains extensive provisions for masonry, but also references *ACI 530-02*. There have been substantial technical changes between the 1999 and 2002 editions of *ACI 530* that must be reviewed. Our review of Chapter 21 indicates that, in general, the references between *ACI 530-02* and *IBC* have been coordinated. This will ease the technical correlation effort. In addition, since Section A9.11 of *ASCE 7-02*, which contains the specific references to *ACI 530-99,* is not adopted by *IBC*, the technical correlation effort can focus on only those sections of *ACI 530-02* referenced in Chapter 21 of the *IBC*.

Chapter 23 of the *IBC*, covering wood construction, is a comprehensive presentation of wood design. Compared to the 2001 *CBC*, the chapter is better organized, more concise, and very usable. *IBC* Chapter 23 contains requirements for both engineered and conventional construction.

NFPA 5000

NFPA 5000's handling of materials standards is less effective than that of the *IBC*. *NFPA* 5000 also references the 2002 editions of steel, concrete, and masonry standards. As with the *IBC*, the steel and concrete chapters, while potentially containing some conflicts, appear to be manageable.

The masonry design provisions present a far greater challenge. Aside from the *ACI 530-02*, there is little in the way of masonry requirements provided. Further, unlike the IBC, there was no apparent effort to coordinate section references between the structural design and masonry standards, nor is it simply a matter of updating the references in *ASCE 7-02* to the correct portions of *ACI 530-02*. Weaknesses in *ACI 530-02* have been identified in 2003 *NEHRP Provisions* update process, that must be considered.

The wood design chapter in *NFPA 5000* (Chapter 45) appears to be unenforceable as written. Chapter 45 contains references to material and design standards, and durability provisions. In the 2001 CBC, wood frame construction is designed using the Allowable Stress Design method. The corresponding provisions in *NFPA 5000* consist of a reference to the American Forest Products and Paper Association (AF&PA) *Allowable Stress Design (ASD) Manual for Engineered Wood Construction*.

The *ASD* manual referenced in *NFPA 5000* actually consists of six documents: the manual itself; the 2001 *National Design Specification (NDS)* for wood and a supplement volume to the *NDS*; a supplement volume covering lumber, glu-lam beams, poles, shear walls, and diaphragms; a supplement volume titled *Special Design Provisions for Wind and Seismic*; and a volume of guidelines covering I-joists, composites, trusses, and metal connectors.

The ASD manual, which is the primary referenced document, is an excellent resource for designers, but it is not an enforceable code document. Of the six volumes that make up the ASD manual only two, the 2001 *NDS* and *NDS Supplement* are written in an

enforceable style. The manual contains examples, “featured projects” such as a fast food restaurant, a warehouse, a reservoir cover, etc., and is more in the form of a textbook and guide than a building code. The volume on special design for wind and seismic is written in a somewhat enforceable style, but the requirements are not incorporated into the manual (the primary referenced document) in an enforceable manner. It also contains material that duplicates and in some cases conflicts with the requirements in other volumes. No order of precedence is established amongst the various volumes.

For conventional construction provisions, *NFPA 5000* references the AF&PA *Wood Frame Construction Manual for One and Two Family Dwellings*, 2001 edition. Although it is an ANSI accredited standard, this two-volume set is also a mixture of enforceable and unenforceable language. The actual conventional construction requirements are scattered throughout the text, interspersed with narrative, design aids, etc. Further, the standard is narrowly scoped to apply only to one and two-family dwellings, and would therefore be inappropriate for use on hospital, licensed clinic, or skilled nursing facilities projects. Nothing in *NFPA 5000* or its referenced documents covers conventional construction requirements for wood buildings under OSHPD’s jurisdiction.

There are other referenced publications in the wood chapter that do not appear to be enforceable, such as the AF&PA *Load and Resistance Factor Design (LRFD) Manual for Engineered Wood Construction* and the Southern Pine Council *Wood Foundations Design & Construction Guide.*

In general, the problems with the *NFPA 5000*, Chapter 45, “Wood,” are systemic, and severe. If adopted, OSHPD would be forced to create an entirely new wood chapter from scratch, built around the 2001 NDS and NDS Supplement.

Tests and Inspections

NFPA 5000 and *IBC* handle structural tests and Inspections in different manners. Chapter 40 of *NFPA 5000* grants the Registered Design Professional broad powers in determining the scope and frequency of tests and inspections. Narrative outlining tests and inspections for different types of construction is given, but references to the appropriate sections of the code or referenced standards are not provided, and the charging language is somewhat vague. Section 1.7.6.6.3 establishes mandatory inspections. However, structural special inspections are not explicitly referenced in Section 1.7.6.6.3.1(N), although there is a reference to Section A.9.3 of *ASCE 7-02*, which does cover some special inspections.

In contrast, *IBC* Chapter 17, “Structural Tests and Inspections,” emphasizes special inspections and required inspections are listed in tables, which also provide references to the appropriate sections of the code or referenced standards.

OSHPD adopts *CBC* Appendix Chapter 33 on site grading. *IBC* contains corresponding provisions in Appendix J. There are no corresponding provisions in *NFPA 5000*.

GENERAL CODE PROVISIONS

Code Format

Although the technical content of the *IBC* is different from the *CBC* in many areas, the format of the *IBC* is similar to the *CBC*. This will make it easier to move existing California amendments to the *IBC* and find appropriate places for new amendments. The format of *NFPA 5000* is very different from the current *CBC*, which will make the task of amending it more difficult, though not insurmountable.

Use of Exceptions within *NFPA 5000*

Another difference with the NFPA format that will increase the difficulty of writing amendments (and increase the confusion of using the code) is NFPA's policy regarding exceptions. The NFPA *Manual of Style* does not permit exceptions when it is possible to word the text as requirements. This sometimes results in confusing or contradictory code requirements. For example, *NFPA 5000* Section 19.1.1.4.1.2 states that "doors…shall normally be kept closed," and Section 19.1.1.4.1.3 states, "doors…shall be permitted to be held open if they meet the requirements of 19.2.2.2.7." On face value, the two sections seem to contradict each other, but the second is really an exception to the first.

In spite of their written policy severely limiting the use of exceptions, the *NFPA 5000* makes liberal use of exceptions in some chapters (See *NFPA 5000*, Chapter 15 Building Rehabilitation – 124 exceptions in 19 pages – and Chapter 16 Assembly Occupancies – 87 exceptions in 16 pages).

In response to our question regarding the policy on exceptions, (see Attachment A, page 9 of 22, question 10), NFPA stated, "NFPA staff has never encountered code text that cannot be effectively expressed in the form of requirements without the use of exceptions. There should never be a case where the 'exception' format is needed. Rather, there is a big need for careful code wording so as to avoid apparent conflicts."

References Within the Model Code

NFPA 5000 also tends to use extremely broad section references in the structural chapters. For example, in Chapter 36, "Soils, Foundations, and Retaining Walls," Section 36.1.1 requires that structures in Seismic Design Categories C through F comply with the requirements of *ASCE 7-02* Sections 9 and A9.7. These two sections encompass over 100 pages, and the NFPA code section forces the designer and plan reviewer to laboriously search through this volume of material, looking for requirements that might apply to soils, foundations, and retaining walls. In contrast, *IBC* refers to specific sections throughout Chapter 18, "Soils and Foundations," allowing both the designer and plan reviewer to focus on the appropriate regulations.

Another example is illustrated by the case of steel piles. *NFPA 5000*, Section 36.5.7 requires that steel piles conform to the requirements of Chapter 44, which in turn never mentions piles. It does reference a number of documents that both the designer and

plan reviewer will have to search, looking for provisions applicable to piling. The *IBC* tends to provide much more precise and complete references to specific code sections. For example, *IBC* Section 1809.3 references the specific requirements for piles, including materials, allowable stresses, and dimensions.

Architectural Amendments
Since both the model codes seem to provide roughly equivalent levels of protection (with some exceptions), we believe they will require a comparable number of amendments to bring either code to the level of the current *CBC*. However, as noted above, the organization and style of *NFPA 5000* will make the amendment process more difficult.

A significant investment of resources will be required to update various OSHPD documents (PINs, CANs, FREER Manual, reference materials) to coordinate with either new code. The *IBC* will require less time for this process, again because of the unfamiliar format of *NFPA 5000*.

Performance-Based Design
NFPA 5000 includes provisions for performance-based design, which allows more flexibility for designers, but greatly increases the amount of work needed to design, review and approve projects utilizing this method. The performance-based design requirements contain requirements that appear vague and unenforceable. For example, the criteria at the serviceability performance level include a structural requirement that “Structures shall not experience permanent deformation or deflection or deformation or deflection that is troubling to occupants or disruptive of building function.” How would the phrase “troubling to occupants” be enforced? ICC has placed its requirements for performance-based design in a separate code document, which appears to be a much better approach.

OTHER CONSIDERATIONS
Training
The amount of training that will be necessary with the adoption of either model code was also considered. There are substantial technical changes in both codes, requiring a significant amount of training to become familiar with these new provisions. From a structural perspective, both designers and building officials will require extensive training on all the referenced standards.

The IBC is organized along the same general lines as the 2001 *CBC*, so the format will be familiar to most users. *NFPA 5000* follows an entirely different format, and additional training will be required to become familiar with this new format. In addition, because of the need for OSHPD to make significant amendments to resolve conflicting provisions, *NFPA 5000* will require more extensive training to understand and properly apply.

"California Code"

The use of a code in California that is different from the one used in the other states is an issue that can significantly impact the cost of doing business in the state. Many owners and designers of health care facilities conduct business in more than one state. Using a building code in California that is radically different from the rest of the nation will impose a tremendous burden on building owners and their consultants. As of June 4, 2003, the *IBC* has been adopted by 26 states, and in various jurisdictions in 43 states. *NFPA 5000* has been adopted in only one city in the nation. If California adopts *NFPA 5000*, it will make the task of architects, engineers and hospitals that do business in California and other states much more difficult and costly.

Insufficient Development

Many building industry professionals feel the *NFPA 5000* code is not yet ready for widespread use. It is a brand new code, presented in a format that has not been used for a modern building code. It incorporates new concepts in building design, and has never been "tested" to demonstrate the effectiveness or usability of these new ideas.

An example that demonstrates how new some of the concepts in *NFPA 5000* are relates to allowable heights and areas of buildings. One of OSHPD's questions to both code organizations requested justification for the increased allowable heights and areas of buildings in both the *IBC* and *NFPA 5000*. In their response, NFPA states that the task group dealing with height and area requirements "set out to develop a new approach, grounded in scientific principles" rather than the "traditional height and area requirements…based primarily upon experience." At one point in the process, the task group "concluded there were still several unresolved issues surrounding this new approach…and it was simply not ready to be included in *NFPA 5000*." Instead, they substituted "heights and areas that are familiar to architects, engineers and code officials," that is, heights and areas virtually identical to those found in the *IBC*.

Support Services

With regard to support services (interpretations, evaluations, training), both organizations have promised to offer roughly equivalent support services. However, ICC has all of their support services in place already, and they are familiar to designers, contractors, and building officials, through their experiences with ICBO. NFPA has promised to provide the same services, but many of them are not yet in place, or are in their infancy. Therefore, there is insufficient data available to be able to evaluate the NFPA support services. In addition, while NFPA has extensive experience supporting the standards, they have no experience providing support for a building code.

Code Development Process

There has been much debate about the influence of the model code development process on the quality of the final code document. ICC has been developed through a "governmental consensus" process that is familiar to users of the *UBC*. In this process, all changes to the code are approved by building officials. *NFPA 5000* is developed using their ANSI accredited consensus process, whereby proposed changes are

reviewed by Technical Committees composed of industry representatives, government enforcers, consumers, business persons and others. Proposed changes are then submitted to a vote of the NFPA membership at the annual meeting. Both methods can produce useful and effective documents, but NFPA's reliance on the ANSI process severely limits their ability to effectively coordinate the host of referenced publications contained in the *NFPA 5000* code, since amendment of one ANSI document by another ANSI document is strongly discouraged.

OSHPD believes that either process is capable of producing an acceptable code document, but the proof of the process is in the product. Rather than prolong the debate over which process is "better," we focused our evaluation on the merits of the actual code document.

Code Organizations

While the ICC is a new organization, combining the ICBO, BOCA and SBCCI code organizations, it is in many ways familiar to those who have worked in the ICBO process. The support services and technical expertise of these three organizations has been merged into the ICC. The *IBC* is a compilation of the three organizations' model building codes. Many decades of code development have been incorporated into the *IBC*, and it has been used throughout the country in the 2000 edition.

NFPA has a long history of standards development. Their documents are used as the industry standard for many types of fire protection systems. *NFPA 5000* is a new building code. Although based largely on *NFPA 101 Life Safety Code*, it has never been used in practice for the design or construction of buildings.

CONCLUSION

Clearly, the task of evaluating these documents for consideration as the basis for the next California Building Standards Code is a monumental task. No one criterion can be ranked above another; fire and life safety, structural, architectural and other portions are equally important. Our evaluation has shown that the fire and life safety and architectural portions of the codes are nearly equivalent, with neither code presenting a clear reason to select one over the other.

The structural issues are quite a different matter. Here, the *IBC* is clearly superior in technical content, completeness, coordination, and presentation. In a number of areas, including, tests and inspections, foundation design, and wood design, the *IBC* is superior to the *CBC,* and vastly superior to *NFPA 5000.*

Both model codes will require amendments to maintain current height, area, and fire sprinkler requirements, and will require amendments to prevent the reintroduction of non-ductile structural systems into California. In the case of *NFPA 5000*, conflicts and omissions exist in the structural provisions that make the document extremely difficult to use in its current form. If adopted, these conflicts will have to be resolved at both the state and local levels. Unfortunately, local jurisdictions can only amend the code for

specific climactic, geographic and topographic reasons, and the state agencies have limited authority for only their statutory jurisdiction. This will leave the local jurisdictions with a building code that contains known conflicts and unenforceable language. Local amendments cannot be adopted at the state level. Therefore, design requirements will vary considerably throughout local jurisdictions statewide.

Based on our analysis, the following codes represent the best choice for buildings under OSHPD jurisdiction, and, in our opinion, for the State of California.

- The *International Building Code*, published by ICC
- The *International Residential Code*, published by ICC*
- The *International Fire Code*, published by ICC
- The *National Electrical Code*, published by NFPA
- The *Uniform Plumbing Code*, published by IAPMO
- The *Uniform Mechanical Code*, published by IAPMO

  * The IRC would not be adopted by OSHPD, but would be useful to jurisdictions regulating residential occupancies in the state.

The following items represent a summary of our reasons for this selection.

- The *IBC* will require much less work to amend. While *NFPA 5000* could be amended to be workable, we estimate it will require double the effort on the part of OSHPD, compared to adoption of the *IBC*.

- The *IBC* is a familiar format, and will be readily accepted by design professionals and building officials. The task of retraining for a new code will be minimized.

- Health and Safety Code Section 18930 (a)(9) (the 9-point criteria) requires that the State Fire Marshal (SFM) review all regulations proposed by State Agencies to determine if the regulation promotes fire or panic safety. Selection of *NFPA 5000*, with its need for extensive amendments, will generate a significant increase in workload at the SFM. This will almost certainly delay SFM's response to the state agencies, which will in turn delay the code adoption cycle.

- Given the limitations imposed by the current fiscal environment in state government, OSHPD is not able to quickly and efficiently handle the volume of work that adopting *NFPA 5000* would create.

- Selection of *NFPA 5000* will result in delays in design and review of projects, as people struggle to become familiar with an entirely different code format. These delays will be costly to the healthcare industry, and will impact the delivery of healthcare services to the people of California.

- The IBC provides a better structure in which to use referenced standards, and allows referenced standards to be amended within the model code to eliminate conflicts.

- The mixture of enforceable and unenforceable language found in portions of the structural provisions of *NFPA 5000*, rather than providing design flexibility, will cause confusion and delays to designers and enforcers, as they struggle to determine exactly what the code requires.

- Because the wood chapter in *NFPA 5000* is unenforceable as written, an entire group of structures under OSHPD jurisdiction (single story Skilled Nursing Facilities and many licensed clinics) cannot be constructed using *NFPA 5000* as written. This will require writing an entirely new chapter for wood design.

- If California adopts *NFPA 5000*, California's design and construction communities will be placed at a severe economic disadvantage when pursuing work outside California. Also, many designers, contractors and building owners in other states may be reluctant to initiate work within California, since working with a totally different building code from the rest of the nation would create economic and logistic difficulties.

- Both *NFPA 5000* and *IBC* will require amendments to maintain a level of safety comparable to that found in the *CBC.* In the case of the structural provisions, the changes needed in the *IBC* are narrow in focus, and chiefly arise from technical changes in the national standards. In contrast, the amendments required to bring *NFPA 5000* to a workable level are broad, arising from systemic issues in scope and format, as well as technical problems. This is most clearly illustrated by the problems with the wood chapter, which is completely unenforceable. Given enough time, the state agencies can address these issues, however, local jurisdictions will be faced with a nearly impossible task as they attempt to enforce these requirements.

- Adopting the *IBC* will fulfill the stated intentions of both ICC and NFPA, in having a single building code that is applicable throughout the United States. This will greatly reduce the burden and frustration of interstate design and construction.

- Finally, and most importantly, the IBC will provide greater clarity, ease of use, and quality, and will therefore result in the highest level of safety for the people of California.

RESPONSES TO OSHPD

Questions on the Fire and Life Safety Provisions

1. Application of a consistent code throughout the country is an important consideration. To date, what state and local jurisdictions have adopted the *NFPA 5000, Building Construction and Safety Code*?

A. NFPA 5000™, *Building Construction and Safety Code*™ is a recently-published document: issued in July 2002, published in September 2002, and available in October 2002. Even with its recent availability, NFPA 5000 is adopted in Pasadena, Texas. And many of NFPA 5000's key life safety provisions have been in use for years across the country. NFPA 5000 is substantially based on NFPA 101, *Life Safety Code*®, which was used as the base document in the drafting of NFPA 5000. The *Life Safety Code* has been extensively adopted at the state level (35 states adopt it in whole or in substantial part) and at the federal level (many federal agencies specifically adopt and enforce the *Life Safety Code*, including the Centers for Medicare and Medicaid Services, Department of Defense, General Services Administration, United States Postal Service, National Park Service, Department of Energy, National Air and Space Administration, etc).

California has long been the leading state in building regulatory advances, and is among the first considering adoption of NFPA 5000. Other states and jurisdictions are in the process of adopting or seriously considering adoption of NFPA 5000 as well, including the City of Phoenix and the State of New Mexico, among others. Also, it is important to note that while the number of model building codes has been reduced to two, the number of different state building codes remains at 50 because each state amends their adopted model code to suit their local needs.

2. What is the correct starting point or method for using *NFPA 5000* for building design and plan review? We have heard various methods presented, and many seem difficult to follow. Should designers and building officials:
    - Start in the occupancy chapters, and then proceed to the chapters for general requirements.
    - Start with the general chapters and move to the occupancy chapters, or
    - Proceed through the code from beginning to end?

A. As with the current California Building Code, there is no set process or path that always has to be followed. Recommended paths of use certainly depend on the purpose of the use.

Understanding the format of this occupancy-based code and the relationships between the different chapters is important for being able to successfully use the code. The format can be broken down as follows:

- Administrative (Chapters 1-5).
- Core Fire & Life Safety (Chapters 6-15).
- Occupancy (Chapters 16-34).
- Structural (Chapters 35-40).
- Materials (Chapters 41-48).
- Building Systems (Chapters 49-55).
- Annex Materials.

Administrative Chapters: Chapter 1 establishes the administrative provisions for the enforcing agency, including inspection and plan review provisions. Chapter 2 lists the standards that are referenced in various sections of the code. Chapter 3 catalogues the definitions utilized throughout the code. Chapter 4 primarily establishes the goals for the code, which are satisfied through enforcement of the prescriptive code. These goals are also necessary in determining equivalency of alternate designs, materials, and methods of construction. Chapter 5 establishes a methodology for determining equivalency for alternate designs, materials, and methods of construction, when alternates are employed.

Core Fire & Life Safety Chapters: Regulations in these chapters set forth the general fire and life safety requirements, such as types of construction, allowable heights/areas, fire resistive construction, means of egress, accessibility, etc. These requirements generally apply, unless specifically addressed in the occupancy chapters. Chapter 6, Classification of Occupancies, is instrumental in the use of the code because it establishes occupancy based on character or use of the facility.

Occupancy Chapters: Each occupancy is regulated by a specific chapter, which provides overall direction for regulation of that particular occupancy. Generally, applicability of the core fire and life safety chapters is established. Each occupancy chapter is formatted similarly and establishes:

- General requirements.
- Means of egress provisions.
- Protection (alarms, sprinklers, etc.) requirements.
- Building services regulations.
- Special occupancy provisions.
- Operating features requirements.

Structural Chapters: These provisions generally apply independent of the occupancy of the building. Chapter 35 provides the general structural design provisions and load requirements.

Materials Chapters: Each chapter addresses regulation of the specified structural material independent of the occupancy of the building.

Building Systems: Each chapter establishes regulations for the specified building system. Many are references to other *Comprehensive Consensus Codes*™, such as the

National Electrical Code®, or the *Uniform Plumbing Code™* or *Uniform Mechanical Code™*.

For plan review and design, the approach outlined below is one example of how a designer or plan reviewer can effectively move thorough the requirements of the code.

1. Is this a new building or renovation/repair to an existing building? See Chapter 15 for regulations affecting existing buildings undergoing construction.

2. Establish if prescriptive-based approach will be used or performance-based approach will be used (Chapter 4).

3. Determine the occupancy classification of the structure. Select occupancy classification(s) and definitions that most accurately fit the use of the building (Chapter 6).

4. Review and check the detailed occupancy requirements for charging language for the fundamental requirements in the core fire and life safety chapters. Any modifications of the fundamental requirements, charging language requires compliance with some or all parts of the core chapters (Chapters 16-30).

5. Determine the actual physical properties of building:

    (a) Determine the building area for each floor (Area definition - Chapter 3).
    (b) Determine the grade elevation for building (Grade definition - Chapter 3).
    (c) Determine the building height in feet above grade (Height definition – Chapter 3).
    (d) Determine the building height in stories (Story definition – Chapter 3).

6. Determine the minimum type of construction necessary for the proposed occupancy by:

    (a) Determining maximum allowable heights and floor areas based on Types of Construction and Occupancy Classification (Table 7.4.1).
    (b) Check allowable height and area increases permitted (Chapter 7).

7. Check detailed construction requirements including, but not limited to:

    (a) Fire protection of structural members (Chapter 7 and Table 7.2.2).
    (b) Fire protection requirements (Chapter 8).
    (c) Means of egress requirements (Chapter 11).
    (d) Elevators (Chapter 54).
    (e) Sprinklers, standpipes, and alarm systems (Chapter 55).
    (f) Use of combustible materials - interior (Chapter 10).
    (g) Roof coverings (Chapter 38).
    (h) Light, ventilation (Chapters 49 and 50).

(i) Sanitation (Chapter 53).

8. Review structural design considerations and material provisions based on the type of material utilized.

9. Check other requirements as necessary.

These steps are naturally varied in sequence by individual preferences; however, the first three are standard steps that should be followed in proper order to assist in design or review of buildings.

3. *NFPA 5000* allows heights and areas that are much larger than what has historically been allowed in the UBC and CBC. What justification was provided to increase the allowable heights and areas so drastically?

A. For the first draft of NFPA 5000, the Structures & Construction Technical Committee formed a Task Group to deal directly with the contentious issue of allowable height and area requirements. Over the course of the code cycle, the Task Group reviewed a substantial number of resource documents on this topic. From this extensive review, the group concluded that traditional height and area requirements are based primarily upon experience and not scientifically derived. So the Task Group set out to develop a new approach, grounded in scientific principles, which was based upon the concept of fire compartments. This new approach was fleshed out and printed in the ROP draft.

However, by the time of the ROC, the Task Group concluded that there were still several unresolved issues surrounding this new approach for regulating allowable heights and areas, and it was simply not ready to be included in NFPA 5000. So at the ROC meeting, the Task Group recommended to the Structures & Construction Technical Committee that NFPA 5000 include an approach based upon heights and areas that are familiar to architects, engineers, and code officials. The numbers found in NFPA 5000 Table 7.4.1 reflect the current provisions in model building codes on the topic and include numbers that are consistent with other NFPA documents, including NFPA 101, *Life Safety Code*.

It is worth noting that the Technical Committee responsible for Chapter 7 is still committed to developing a new scientific approach to allowable height and area requirements based upon fire compartments.

4. Allowable heights and areas are much larger for ambulatory health care facilities than even the IBC allows (and far exceed the limits in the CBC). What justification is given for such large and tall buildings where patients are rendered incapable of self-preservation?

A. The heights and areas limitations for ambulatory health care (AHC) occupancies are nearly identical to those for business occupancies, with the exception of the height limitations for nonsprinklered buildings of the unprotected construction Type II (000),

Type III (200), and Type V (000). This is based on the premise that AHC occupants utilize a protection package that starts with the requirements for a business occupancy and then adds extra protection requirements, such as subdivision of building space via smoke barriers. The smoke barriers create smoke compartments that serve as refuge areas allowing patients to wait-out the emergency, be "revived" to ambulatory status, or otherwise prepared for evacuation by staff.

The number of patients rendered incapable of self-preservation in an ambulatory health care occupancy typically does not outnumber the staff available to help with patient movement. This approximate one-to-one ratio is not mandated by the code, but is provided for functional purposes. A patient who is administered general anesthesia is generally surrounded by an anesthesiologist, another specialist such as a surgeon, and one or more nurses. Recovery rooms have similar high staffing levels. Thus, the height and area limitations for AHC occupancies are justified in being nearly identical to those for business occupancies. Where AHC height limitations are stricter than those for business occupancies [that is, for nonsprinklered buildings of the unprotected construction Type II (000), Type III (200), and Type V (000)], there is a recognition that with non-rated floors, non-rated structural supports, and no sprinklers, the structural integrity of the building is not assured for the time needed to evacuate nonambulatory patients.

5. *NFPA 5000* offers substantial "trade-offs" in construction for automatic sprinkler systems. It is very likely that an earthquake may render such sprinkler systems inoperative in areas of high seismic activity. Additionally, sprinkler systems may be shut off for maintenance or service. How are buildings protected against fire, where sprinkler systems are used for trade-offs and then fail to operate when needed?

A. Over the past five years, the trend in all model building codes has been to allow reductions in some required protection features where automatic fire sprinklers are provided. Sprinkler systems provided for purposes of complying with the construction alternatives offered by NFPA 5000 must be installed per NFPA 13, *Standard for the Installation of Sprinkler Systems*, which includes a host of seismic design and bracing requirements. In areas of high seismic activity, if a sprinkler system is subject to damage, other construction features such as fire barriers are also subject to damage. Likewise, earthquake damage does not immediately translate into a fire emergency or the need to evacuate.

Let's use a hospital as an example. If sprinkler systems are damaged in an earthquake, hospital administrators might decide that the evacuation and relocation of patients to another facility is needed because the defend-in-place strategy that relied on sprinkler protection can no longer be assured to work. Similarly, if a fire barrier (for example, the smoke barrier that creates a minimum of two smoke compartments on each patient floor) is damaged by earthquake, hospital administrators might decide that the evacuation and relocation of patients to another facility is needed because the defend-in-place strategy that relied on fire/smoke barriers can no longer be assured to work.

On the subject of sprinkler systems being shut off, there are two issues: (1) inadvertent or unauthorized valve closure, and (2) maintenance or service shut downs.

Inadvertent or unauthorized shutoffs are addressed by the requirement that sprinkler systems must be supervised. Supervision, per NFPA 5000, must be electrical supervision so that appropriate notification is provided automatically any time a valve is closed. Such supervisory signals must sound and be displayed either at a location within the protected building that is constantly attended by qualified personnel or at an approved, remotely located receiving facility.

NFPA 5000 also addresses the issue of sprinkler systems being shut off for maintenance. For example, in the high-rise building provisions, 33.2.2.2 and 55.3.1.6 require that a sprinkler control valve be provided on each floor. This multiple valve arrangement permits for the sprinkler system to be shut off only on the floor where maintenance/service is to be performed while all other floors remain protected by sprinklers.

NFPA 5000 is part a coordinated set of codes and standards for the built environment. It relies on the adoption and enforcement of a fire prevention code such as NFPA 1, *Uniform Fire Code*™. The fire code has additional requirements addressing the number of hours a sprinkler system can be out of service before a fire watch must be provided or the building must be evacuated.

6. The NFPA *Manual of Style* includes "reasonable" in the list of "possible unenforceable and vague terms," which "shall not be used within the body of codes or standards" if the language is unenforceable or vague. In light of this requirement, and the fact that virtually all of Chapter 4 of *NFPA 5000* uses phrases such as a "reasonable level of safety," "does not unreasonably affect…," "provide reasonable assurance," and "consistent with reasonable expectations," how can a building official apply and enforce Chapter 4 of *NFPA 5000*?

A. Section 4.1 of NFPA 5000 establishes the goals and objectives for the prescriptive code. It is an integral and important part of the overall document, not only for the prescriptive code but also for the performance-based design options. Yet, Section 4.1 is not intended to be directly and independently enforced. In fact, compliance with the prescriptive requirements of the code satisfies the goals and objectives set forth in Section 4.1.

More specifically, the goals and objectives in NFPA 5000 serve as:

(a) The bases for which the NFPA technical committees developed the prescriptive-based requirements of Chapter 1 through Chapter 4 and Chapter 6 through Chapter 55 of the code. The prescriptive requirements inherently reflect the goals and objectives of section 4.1. The vast majority of building projects will use the prescriptive option, so, again, Section 4.1 is not meant to be directly and independently enforced.

(b) The bases for which the NFPA technical committees developed the performance criteria of Section 5.2 for use with a performance-based design in accordance with Chapter 5. Performance-based designs will typically be used only for construction projects utilizing alternate design, materials, or methods of construction. The Authority Having Jurisdiction (AHJ) will typically rely on an approved, independent third party reviewer, as permitted by 5.1.3. So, once again, Section 4.1 is not meant to be directly and independently enforced.

7. What is the correct occupant load factor for assemblies?

- Section 16.1.6 states that occupant load is to be determined using the load factors in Table 11.3.1.2. This table provides different load factors for different uses, ranging from 3 sf per person to 100 sf per person. The next sentence in section 16.1.6 says that the occupant load shall not exceed one person in 5 sf in areas not in excess of 10,000 sf, and one person in 7 sf in areas in excess of 10,000 sf.
- At the NFPA presentation to the state agencies, when I asked how to apply these seemingly different requirements within the same code section, the presenter told the group that the different requirements give the designer more options in designing the building. Rather than options, this seems to add confusion and inconsistency.

A. Note that the first column of Table 11.3.1.2, Occupant Load Factor, is titled "Use" and not "Occupancy." It is possible to have an assembly use that is not an assembly occupancy. For example, if a meeting room for approximately 20 persons is located in an office building (that is, in a business occupancy), the meeting room would be an assembly use and it would be part of the business occupancy. The occupant load of the meeting room would be calculated using either the 7 ft^2 or 15 ft^2 per person occupant load factor from Table 11.3.1.2. Because of the presence of tables and chairs, the 15 ft^2 per person factor for "less-concentrated assembly use" is chosen for use in calculating the occupant load.

Table 11.3.1.2 does not offer the 3 ft^2 per person occupant load factor for an assembly use. The table offers the range of 7 ft^2 through 100 ft^2 per person. The 3 ft^2 per person occupant load factor is for use only for a specialized form of waiting space in an assembly occupancy. The code user learns this, not from Table 11.3.1.2, but from going to the assembly chapter and reading 16.1.6.1. Further, by going to Chapter 16 for an assembly occupancy, the code user learns from 16.1.6 about the maximum packing densities via a set of 5 ft^2 and 7 ft^2 rules.

So, the intent of Table 11.3.1.2 is to provide the generalized occupant load factors for various uses; and the intent of 16.1.6 and 16.1.6.1 is to provide unique, specialized guidance on occupant loads in assembly occupancies. This is the typical format used in NFPA 5000 where the means of egress chapter (Chapter 11) provides the general egress information, and the occupancy chapters (for example, Chapter 16 for assembly) provide the specialized criteria and deviations from the general provisions.

In piecing together the generalized data in Table 11.3.1.2 and the specialized provisions of 16.1.6 and 16.1.6.1, the code user dealing with an assembly occupancy learns:

(a) Use 7 ft^2 per person where furniture is almost nonexistent, such as for a stand-up reception or a dance floor; this is referred to as "concentrated use" in Table 11.3.1.2.

(b) Use 15 ft^2 per person where there is furniture occupying part of the space, such as for a meeting room or dining area; this is referred to as "less-concentrated use" in Table 11.3.1.2.

(c) Increases in occupant load are permitted over the number of persons calculated using 7 ft^2 and 15 ft^2 per person (see 11.3.1.3 through 11.3.1.3.2 and the second sentence of 16.1.6). Provided the area does not exceed 10,000 ft^2, patrons of the assembly occupancy are permitted to be "packed-in" at the rate of 1 person per 5 ft^2. In areas greater than 10,000 ft^2, the maximum packing density permitted is 1 person per 7 ft^2. This is because the patrons in the larger venue will tend to move toward the attraction (for example, toward the band on the stage at the front of the room). Such movement will leave the back of the room sparsely occupied and the front of the room more densely occupied, even though the average for the room is 7 ft^2 per person. In smaller venues, 5 ft^2 per person is permitted because the occupant loading density remains fairly constant throughout the room.

(d) For specialized waiting spaces (for example, the space in a movie theater lobby where ticket holders are corralled by ropes supported on stanchion posts), the occupant load is permitted to be set at 1 person per 3 ft^2. The 3 ft^2 per person occupant load factor is not for use where patrons belly-up to the bar 3-deep waiting to be served a beverage.

The numerous provisions for occupant load calculations in assembly occupancies are necessary. It would be unfair to the venue operator to establish just one option such as 15 ft^2 per person when additional patrons can be safely accommodated. Similarly, it would be unfair to the AHJ if all assembly occupancies were permitted to pack patrons into an area at the rate of 1 person per 5 ft^2 when safety cannot be assured. Some facilities can safely accommodate patrons at 5 ft^2 per person and others cannot. The detailed criteria of 16.1.6 regulate the subject fairly.

8. What is the correct application of the height increase allowed for residential sprinklers in section 7.5.2? It is not clear if section 7.5.2 is an exception to section 7.4.1 (allowing an NFPA 13R system for residential occupancies instead of the NFPA 13 system required in 7.4.1), or if this is an additional increase to the sprinklered heights shown in Table 7.4.1 for any occupancy, or something else.

   Also, depending on the type of construction, the maximum height in the table for non-sprinklered buildings exceeds the allowable heights in section 7.5.2 for residential buildings sprinklered with a 13R system (the allowable height for a non-sprinklered building exceeds the allowable height for a 13R sprinklered building). Not until one

looks at the specific application of NFPA 13R does one find that it can only be used in buildings not exceeding four stories in height. The four-story limit specified in section 7.5.2 is actually not a limitation of the residential occupancy, but rather of the 13R sprinkler system that may be used in the building.

A. NFPA 5000, Table 7.4.1, allows an increase in both the maximum building height and allowable number of stories above grade when a building is protected throughout with an approved, electronically supervised sprinkler system in accordance NFPA 13 (as specified in Section 55.3.1.1(1)).

In addition to these requirements in Table 7.4.1, Section 7.5.2 limits the user to a 20 ft increase in the overall height and a 1-story increase if a NFPA 13R system is substituted for a NFPA 13 system. Section 7.5.2 only allows a NFPA 13R system to be used if the overall building height does not exceed 60 ft and the maximum number of stories does not exceed four stories.

9. Does the area increase for sprinklers (section 7.6.2.2) apply to building areas in Table 7.4.1 where the occupancy is not permitted in non-sprinklered buildings?

A. NFPA 5000, Section 7.6.2.2, allows an increase in the allowable area per floor for sprinklered buildings. This option applies to any building that is protected by an approved, electrically supervised automatic sprinkler system installed in accordance with NFPA 13.

In the situation where a particular occupancy is required to be sprinklered, the designer is still permitted to utilize this automatic sprinkler increase for the building, unless it is specifically prohibited by the occupancy- or use-specific chapter (NFPA 5000, Chapters 16-34).

10. The NFPA *Manual of Style* requires that exceptions be worded as requirements whenever possible. Why has the exception format not been retained when the resulting text is awkward, confusing or contradictory? For example, section 19.1.1.4.1.2 states that "doors…shall normally be kept closed," and section 19.1.1.4.1.3 states that "doors…shall be permitted to be held open if they meet the requirements of 19.2.2.2.7." The two sections say opposite things, when one is actually an exception to the other.

A. NFPA staff has never encountered code text that cannot be effectively expressed in the form of requirements without the use of exceptions. There should never be a case where the "exception" format is needed. Rather, there is a big need for careful code wording so as to avoid apparent conflicts. The wording of 19.1.1.4.1.2 and 19.1.1.4.1.3, as questioned, is not contradictory, it is complimentary as an exception.

Differing formats is a matter of preference.

11. Does NFPA anticipate that the "weighted width" formula in the frontage increase calculation will be widely used? With the summation function, the formula will be virtually unusable by architects and building officials without extensive education and recent experience in higher math skills.

A. NFPA 5000, Section 7.6, allows the floor areas specified in Table 7.4.1 to be increased to account for frontage and automatic sprinkler protection. The equation for the frontage increase includes a variable, W_w, which contains a summation function, ?.

Although this area increase is optional for the designer, this formula will be used in many cases to increase the building's allowable area. It is anticipated that most architects and building officials are equipped with the education to utilize this algebraic equation. However, along with this code, it is anticipated that there will be tools, such as handbooks and computer programs, available to assist users in the proper application of this equation.

It may also be worth noting that the use of this algebraic symbol is a growing trend in codes and standards that deal with additive equations of varying length. For example, this summation function is utilized in many sections of the current California Building Code, including sections 1630.2.2, 1630.5, and 1910.11.4.2. Additionally, the summation symbol is used extensively in standards referenced by all model codes, such as ASCE 7-02.

12. Section 19.2.2.2.4(1) permits door locking arrangements if keys are carried by staff, with no limit to the number of locks in the egress path. 19.2.2.2.4(2) permits delayed-egress locks, but no more than one such device is permitted in the egress path. Why are any number of manual locks permitted, and only one delayed-egress lock, when delayed-egress locks have the added protection features of section 11.2.1.6.1?

A. Chapter 19, Health Care Occupancies, was written with full knowledge that staff is present in sufficient numbers, for day-to-day functional purposes, to assure that NFPA 5000 requirements that rely on staff assistance can be effectively relied upon as part of the overall protection package. Doors are permitted to be locked for the clinical needs of the patients. For example, to prevent Alzheimer's patients from wandering away from their unit and encountering dangers such as falls down stairs or exposure to harsh outdoor weather conditions. Thus, the nursing staff is permitted to be responsible for unlocking multiple doors; staff does this while accompanying patients. Often such unlocking of doors is done to get to an adjacent smoke compartment as part of the defend-in-place concept employed. Contrast that with the delayed egress lock that will find its main application in portions of the building where there are fewer "locked-in" patients. Ambulatory patients, general staff, and visitors can be expected to encounter the delayed egress lock without having nursing staff at their side. Expecting someone without trained nursing staff at their side to be willing to wait multiple times for delayed egress locks to unlock is not reasonable.

13. Section 19.2.5.9 does not permit corridors to pass through any intervening rooms or spaces, other than corridors or lobbies. Section 19.3.6.1 permits many different rooms, areas and spaces to be open to the corridor. How does one reconcile these two sections?

A. The provisions of 19.2.5.9 address the same concept that 11.5.1.2 does, only 11.5.1.2 does it better because it states "…other than corridors, lobbies, and other spaces permitted to be open to the corridor." The concept is one of requiring access to an exit directly from the exit access corridor without having to enter some other use space. The thought is that there is no assurance of proper control over those other spaces, so having to pass through them does not assure safe egress. The health care technical committee will probably be in favor of modifying the wording of 19.2.5.9 to be identical to that in 11.5.1.2. The health care technical committee developed the wording of 19.2.5.9 long before the subject was addressed in the Chapter 11 egress provisions. The committee felt the language has been adequate historically because of the operative words "(not) pass through." Although 19.3.6.1 permits areas to be open to the corridor, egress cannot be through such areas. See, for example, 19.3.6.1(1)(d), 19.3.6.1(2)(c), and 19.3.6.1(5)(c), which all use the words "The area/space does not obstruct access to required exits," which is meant to require such spaces to be off to the side of the corridor.

14. Section 19.3.6.1(1) permits spaces of unlimited area and unspecified use to be open to the corridor. Apparently, the only limitations are that the spaces cannot be used for patient sleeping or treatment or hazardous areas, and they are protected with a smoke detection system. Does this permit a hospital without walls, except for patient sleeping and treatment rooms, hazardous areas and smoke barriers?

A. The space that is open to the corridor cannot be used for patient sleeping, treatment, or any use that creates a hazardous area (for example, storage, mechanical space, trash collection, soiled linen, laundries, laboratories). That leaves very few uses that would be compatible with running an effective health care occupancy. For example, although it would not be prohibited to place the accounting office in a space open to the corridor, functional needs dictate that the accounting department will not reside in spaces left open to a corridor within a patient sleeping unit. So, the question is purely academic; a hospital without walls (except for patient sleeping room walls, treatment room walls, hazardous area walls, and smoke barrier walls) just won't happen. The spaces permitted to be left open to the corridor will continue to be the traditional areas such as waiting spaces, solariums, and patient activity spaces.

15. Why is "Nonsprinklered Existing Building Rehabilitation" (Section 19.4.3) in chapter 19, and not in chapter 15? The use and application of Chapter 15, Building Rehabilitation, is extremely confusing.
16. The path to find information or requirements is often very confusing. Section 19.1.1.1.3 refers to chapter 15 for repairs, etc. Section 15.5.1.2.3, refers to section 15.6.2.5.2.3, which refers to section 19.1.1.4.3 for sprinkler requirements. Section 19.4.3.1 refers to projects exempted by section 15.5.1.2.3 from the sprinkler

requirements of section 19.1.1.4.3, which must comply with the requirements of sections 19.4.3.2 through 19.4.3.6, etc.

A -15 and 16. The requirements of Chapter 19, Health Care Occupancies, are predicated on the presence of a fully sprinklered building. Where rehabilitation projects are of a small enough magnitude to exempt the smoke compartment undergoing the rehabilitation from being sprinklered, it is important to steer the code user directly to subsection 19.4.3 without leading them to Chapter 15. Otherwise, the code user will attempt to use the requirements of 19.1 through 19.4.2 without modification, and that will lead to an inadequate level of protection for a nonsprinklered smoke compartment. The requirements of 19.4.3 introduce extras that are needed if there are no sprinklers, but not needed if sprinklers are installed. The wording in Chapter 15 serves as a cross reference so Chapters 19 and 15 do not conflict. It might be confusing at first, but in application it works and there are no conflicts.

There might be ways to simplify the roadmap of provisions for future editions of the code. The technical committees involved thought it was imperative that the first edition of NFPA 5000 offer the unique options presented by Chapter 15, Building Rehabilitation. The presence of Chapter 15 shows how the NFPA documents are state-of the-art and responsive to user needs. Had Chapter 15 not been included in the 2003 edition, there would be no incentive for the adaptive reuse of existing buildings. Chapter 15 is offered for use with all occupancies. Health care occupancies are unique in that spaces are rehabilitated on an ongoing or never-ending basis.

Questions on the Structural Provisions

1. Describe the acceptance criteria used to select referenced publications for the code.
    a. Are there standards for style and format?
    b. What criteria are used to determine enforceability of the referenced publications?
    c. Is the participation of enforcement agencies in the development of the referenced publications a consideration?
    d. How are the issues of referenced publication cost, availability, and policies on updates and errata considered?

A -1a. and 1b. Acceptance and incorporation of referenced codes, standards, and other documents is strictly governed by the NFPA Regulation Governing Committee Projects (RGCP). Section 3-3.7, which is on page 52 of the 2003 NFPA Directory, establishes the criteria.

The documents that are referenced in the main body of the code: 1) must use mandatory language (see 3-3.7.1.1); 2) must typically be available for review at NFPA headquarters (see 3-3.7.1.1); 3) must be developed using an open process, which is generally, but not exclusively the American National Standards Institute (ANSI)-accredited process (see 3-

3.7.1.2); 4) may be allowed to not meet the criteria for open process when other choices are not available (see 3-3.7.1.3).

NFPA technical committees are charged with making the determination whether a particular referenced code or standard needs to be included in the document and complies with the RGCP. Design and construction criteria are so complex and broad today, that there is no way to capture all of the relevant information in a few sentences within a model building code. Generally speaking, NFPA technical committees would only reference other documents that were consistent with one or more of the stated goals and objectives in Chapter 4 of NFPA 5000. Since availability of the referenced document is a crucial concern in the NFPA process, NFPA technical committees almost always reference the edition of the document that will be available when the new NFPA code is issued.

A - 1c. Participation by a particular entity, such as code enforcement agencies, is desirable, but it is not a specific condition of review or acceptance for a referenced document. As noted in 1a and 1b, NFPA regulations stipulate a preference for referenced documents that are developed using an open process. It is important that no interests such as code enforcers be excluded from participating in the process of developing a referenced standard. In fact, the NFPA RGCP gives precedence to an open, voluntary consensus process, such as the ANSI-accredited processes, so that all interests have the opportunity for equal participation throughout the process. The category of "Regulators" is a standing interest category in the ANSI procedures.

A - 1d. All model codes use referenced standards, and all model codes indicate that the referenced standards are considered part of the model code. NFPA 5000 references 428 documents and NFPA 1 references 210 documents. The total number of references for the NFPA model building and fire codes is 638, which is considerably fewer than the number of referenced standards for the three ICC codes.

Specifically, the IBC references 518 documents, the IRC references 542 documents, and the IFC references 182 documents. Because adoption of the IBC also requires adoption of the IRC, the total number of references for the ICC codes is 1242. Agencies or jurisdictions using the ICC codes will have to purchase all of these documents from the ICC. And not only will jurisdictions have to purchase a building and fire code, but also a residential code and its referenced standards. This additional ICC code also forces jurisdictions to purchase additional training, certification, and resource material.

In order to be considered by NFPA for referencing, the NFPA technical committees make the following determinations:

- Does the document include information that is relevant to the subject at hand?
- Does it make the code better?
- Does it improve upon the level of safety?
- Does it provide guidance that will enhance building design and performance?

Since availability of the referenced document is a crucial concern in the NFPA process, technical committees reference the edition of the document that will be available when the next edition of the NFPA code is issued. The policy on updates to the referenced document is not a standing criteria. Technical committees will usually be made aware of the typical update to the document as a part of the review of the referenced standard.

2. Describe the methods used to review referenced publications cited in the structural chapters, prior to adoption into the code.
    a. What process is used to evaluate and amend the referenced publications?
    b. How many individuals review each publication?
    c. How much time is allotted to the effort?
    d. Is there a written public record of the findings and recommendations of the reviewers?

A - 2a. NFPA Regulations Governing Committee Projects, Section 4, clearly outlines the process of developing and revising documents. Within the context of this process, both the Structures and Construction Technical Committee and the Building Materials Technical Committee formed Task Groups for each of the structural and material chapters in order to recommend requirements to the technical committees on each specific topic. Parts of the Task Groups' work included reviewing and evaluating appropriate reference documents. For guidance in this particular area, the Task Groups turned to NFPA Regulations Governing Committee Projects, Section 3-3.7, which dictates the acceptance criteria for outside references codes, standards, and other documents.

In general, NFPA discourages technical committees from amending or revising the work of other ANSI committees. These specialized committees tend to have substantial expertise in a very narrow topic, and, as such, the NFPA 5000 technical committees, whose knowledge base is broader, need to respect this expertise. That said, however, the NFPA 5000 technical committees have the opportunity to amend the referenced document through the NFPA code development process. In addition, technical committees are encouraged to submit modifications correcting the problem to the document in question. As such, NFPA attempts to be directly involved in the development of other key referenced documents, or encourage those involved with other key documents to be involved in the development of the referencing NFPA code.

A - 2b. The Task Groups charged with reviewing each of the structural and material chapters varied in size considerably, from less than a handful to well over a dozen, depending upon the complexity of the topic. The individuals assigned to the Task Groups are recorded in the Technical Committee Meeting Minutes. Copies of the meeting minutes from the pre-ROP, ROP, and ROC meetings of both the Structures & Construction Technical Committee and the Building Materials Technical Committee are public record and available for your review.

Please keep in mind that each of the Task Groups presented their recommendations to the responsible technical committee. It was then the full technical committee that acted upon the Task Groups' recommendations. Those actions are recorded in the ROP and ROC.

A - 2c. Because this review took place within the confines of the NFPA 5000 code cycle, it was completed inside the standard 24 month cycle.

A - 2d. The meeting minutes cited in the answer to Question 2b are public record and contain summaries of the Task Group reports. In addition, the ROP and ROC, which are also part of public record, contain further public documentation of the process.

3. Identify and describe the duties of the individuals responsible for coordinating referenced publications.
    a. How is the scope of the referenced publications (as applied in the code) determined?
    b. What is the process for identifying and remedying conflicts?
    c. How many individuals review the referenced publications for potential conflicts?
    d. What are the criteria used to judge compatibility of the referenced publications with other structural requirements of the code?

A - 3a. NFPA technical committees have a wide realm of responsibility for determining what is and is not appropriate to reference in the code. The technical committees establish what is relevant to the code requirement. In some cases, the technical committees utilize task groups to review and recommend referenced documents and their applicability within the main code. In addition to verifying that it meets the criteria of the NFPA regulations, the technical committees must judge if the referenced document is technically consistent with the goals and objectives of the code (See NFPA 5000: Chapter 4).

A - 3b. NFPA 5000 Sections 1.3.2 and 6.4.1.2 delineate the authority for precedence. Any conflicts between the code and referenced documents default to the requirements of the code. NFPA technical committees are composed of technical experts who are normally intimately aware of the requirements of the referenced documents. Differences between the referenced document and NFPA 5000 are usually identified and the technical committee will then decide on how to proceed. That is, whether to knowingly move forward with a difference, to adjust the criteria in NFPA 5000 so as not to conflict (if possible) with the referenced document, or to develop an appropriate revision to the companion referenced document to be submitted to the companion document's development committees for consideration during its next code development cycle.

A - 3c. Besides task groups that may review the referenced document, the technical committee has responsibility for reviewing the recommendation from the task group to make a formal recommendation. In the NFPA Building Code project, a technical correlating committee also reviews the work of the 16 technical committees. All told,

there are approximately 50 to 60 members of task groups, technical committees, and the technical correlating committee who have an opportunity to review the selection of the referenced publications. Additionally, many other people participate in the development process. They, too, have the opportunity to review the document and comment.

A - 3d. Once again, the task groups, technical committees, and the technical correlating committee review, recommend, and judge compatibility of referenced standards with the provisions of the code.

From a structural point of view, the national trend is the development of a system that revolves around the National Earthquake Hazard Reduction Program (NEHRP). The expert or parent document for structural design that complies with this national program is ASCE 7, *Minimum Design Loads for Buildings and Other Structures*, 2002. NFPA committees elected to take the approach that ASCE-7 should be used as the basis for all structural design issues. Amendments to ASCE-7 were determined to be not in the best interest of codes, authorities having jurisdiction, or of designers, as many conflicts would be created. In addition, ASCE-7 is largely coordinated with many of the material standards (ACI, AF&PA, and AISI) as well as with criteria from FEMA. The NFPA technical committees referenced ASCE-7 without amendment, thus bringing to bear a set of coordinated structural requirements from another ANSI-accredited organization.

4. Reference publications produced by the steel, concrete, masonry, and timber industries are valuable resources. However, they also reflect the bias of the industry group, and may include structural systems or methods of construction suitable only for areas of low seismic risk. What processes are used to screen the referenced publications to ensure systems of low ductility are not constructed in regions of high seismic risk?

A. The same process outlined in the answer to Question 2 of this section would be utilized to screen the referenced publications to ensure systems of low ductility are not constructed in regions of high seismic risk.

5. *NFPA 5000* contains numerous references to guidelines and handbooks. These documents may not be written in enforceable language, and often contain information that may be in direct conflict with other reference standards, yet they are accorded the full weight of code language, since Section 2.1 states that the documents or portions thereof referenced within the code shall be considered part of the requirements of the code. When conflicts arise, how would a Building Official determine what language takes precedence?

A. As indicated in the answer to question 3b, NFPA 5000, Sections 1.3.2 and 6.4.1.2, delineate the authority for precedence. Any conflicts between the code and referenced documents default to the requirements of the code. NFPA technical committees are composed of technical experts who are normally intimately aware of the requirements of the referenced documents. Differences between the referenced document and NFPA

5000 are usually identified and the NFPA technical committees will then decide on how to proceed. That is, whether to knowingly move forward with a difference, to adjust the criteria in NFPA 5000 so as not to conflict (if possible) with the referenced document, or to develop an appropriate revision to the companion referenced document to be submitted to the companion document's development committees for consideration during its next code development cycle.

6. If a referenced publication in turn references other documents, are these documents also considered to be a part of the building code? If not how is the referenced publication to be enforced?

    - *NFPA 5000* sometimes references different editions of material standards than those in ASCE 7-02. For example, NFPA 5000 references ACI 530-02 for masonry design, while ASCE 7-02 is based on ACI 530-99. Similarly, *NFPA 5000* references AISC Seismic Provisions for Structural Steel Buildings 2002, while ASCE 7-02 is based on AISC Seismic 97, with Supplement 2. Where there are technical differences, which edition of the material reference is enforced? If a version of a standard different from that specified in ASCE 7-02 is enforced, what steps have been taken to ensure that compatibility in design assumptions between ASCE 7 and the material standard is maintained?

A. In general, secondary and tertiary references in the referenced documents are not considered to be a part of the NFPA code, thus do not need to comply with the NFPA Rules Governing Committee Projects. It is really a decision of the jurisdiction as to how far they may want to drill down into secondary and tertiary referenced publications. NFPA 5000: 2.1 states "The documents or portions thereof listed in this chapter are referenced within this Code and shall be considered part of the requirements of this document." It does not carry that responsibility out to the documents referenced within the referenced publications. There are situations, however, that common sense and logic will dictate that use of a secondary reference is necessary. For example, NFPA 5000 requires the use of sprinkler systems that comply with NFPA 13, *Standard for the Installation of Sprinkler Systems*, 2002 edition. A sprinkler system with an adequate volume of water, but inadequate pressure, would need to have a fire pump included as a part of the design package. NFPA 13: 15.2.2 permits fire pumps installed in accordance with NFPA 20, *Standard for the Installation of Stationary Pumps for Fire Protection* to serves as an acceptable source of water. NFPA 20 is not referenced in NFPA 5000, but logic would dictate that it is the best method to regulate the design of the pump system. Such criteria, however, is best called out in the construction plans and specifications that are submitted for review.

A - Sub-bullet. In certain cases, NFPA 5000 references different editions of material standards than those found within ASCE 7-02, Section 9.0, *Earthquake Loads*. For example, NFPA 5000 references ACI 530-02 for masonry design, while ASCE 7-02, Section 9.11 references ACI 530-99 for the design, construction and quality assurance for masonry components that resist seismic forces. In addition, Appendix A.9.11 of ASCE-7

provides supplementary provisions for the seismic compatibility between ASCE 7-02 requirements and those of ACI 530-99.

This is an example of lag timing of the various code development processes involved. ACI had not finished processing ACI 530-02 in time to make the appropriate modifications in ASCE 7-02. However, ACI had finished processing ACI 530-02 in time to be referenced in NFPA 5000.

It is certainly in California's best interests to adopt and enforce the most up-to-date codes and standards available. Consequently, as part of the review process, California will want to compare the seismic provisions of ACI 530-99 with ASCE 7-02's modifications to those of ACI 530-02 to determine if there are conflicts and how best to deal with those conflicts.

This issue is not unique to NFPA, but also finds its way into the other model building code documents, past and present.

7. How are structural elements and systems that bridge several different referenced publications handled? Which publication takes precedence?

A. As with any model code, there are structural elements and systems that bridge several different reference publications. Take, for example, the seismic requirements for composite construction found in Section 44.2.4 of NFPA 5000. In this section alone, four reference documents are called out – ACI 318, AISC LRFD, ASCE 7 and AISC Seismic, Part II. When necessary, the code language indicates which publication takes precedence. For instance, Section 44.2.4.2 indicates that the ASCE 7 *R* factor can be used when the structure is designed and detailed in accordance with the provisions of AISC Seismic, Part II.

8. How are the performance-based design options outlined in chapter 5 to be translated into enforceable design requirements? For example, Section 5.2.3.2 Serviceability Performance states "…structures shall not experience permanent deformation or deflection that is troubling to occupants or disruptive to building contents…" What criteria would be used to determine compliance with this requirement?

A. All model building codes, including NFPA 5000, have allowances for the use of alternative materials and methods of construction. But only NFPA 5000 establishes clear, concise goals and performance-based design provisions within the model building code for when this design option is utilized. The goals and objectives established in chapter 4 and the performance-based design provisions in chapter 5 establish a methodology for building owners, designers, and enforcers to utilize in order to establish equivalencies for compliance. No other building code integrates this level of support to the use of alternate materials or methods of construction.

The complexity and sheer amount of design, modeling, and documentation-preparation time associated with a performance-based design will severely limit the use of the

performance-based options to unique projects. As with any alternate design, material, or method of construction utilized under the existing California Building Code, stakeholders (which include the code enforcer) are expected to begin working together at the project inception stage with the task of determining equivalency. The burden is placed on the design team to translate the performance criteria into measurable design elements. NFPA 5000 provides the methodology for determining equivalency.

9. Describe the services that NFPA currently provides to enforcement agencies for code support.
    a. Does NFPA provide interpretation services for questions on the referenced publications?
    b. Does NFPA currently provide product evaluation services?
    c. Does NFPA currently provide certification programs for inspectors, special inspectors, and plan reviewers? If so, please identify each type of testing and certification program.

A - 9a. NFPA has provided interpretation advisory services for many decades. In fact, NFPA responds to more that 30,000 interpretation requests each year. NFPA has a diverse technical staff of 120 professionals from appropriate disciplines to provide advisory services. NFPA's staff is composed of the following professions: Architecture, Building Officials, Chemical Engineering, Electrical Engineering, Engineering Physics, Fire Officials, Fire Protection Engineering, Mechanical Engineering, and Structural Engineering.

NFPA provides interpretation advisory services to NFPA members and to jurisdictional representatives at no charge. As an enforcing agency, OSHPD staff would receive the benefits of this service at no charge, regardless of membership status with NFPA. Instructions for taking advantage of this service are found on NFPA's Web site. Interpretation assistance may be in the form of telephone calls, e-mail, or letters. While NFPA staff strives to answer these requests immediately, verbal interpretations will be handled within one to two business days and written responses are handled within 5 to 10 business days.

Formal interpretations (see pages 60-61 of the 2003 NFPA Directory) are actually processed by our Technical Committees and can take three months since the responses are letter balloted by the Technical Committee members. If a formal interpretation is requested, it must be submitted on a form, which is available online. Formal interpretations are then processed through the appropriate NFPA Technical Committee, and once finalized are published and available as part of a subscription service.

This interpretation advisory service applies to the building code and also to questions on sprinklers, electrical systems, fire alarm systems, hazardous materials, or any of the subjects noted in the NFPA referenced documents listed in Chapter 2 of NFPA 5000.

NFPA will provide interpretation advisory service regarding referenced documents not promulgated by NFPA relating to applicability within the NFPA code. Though

discussion may occur regarding the technical details of a referenced document not promulgated by NFPA, the requestor will be advised to seek interpretation assistance from the promulgating organization.

NFPA also provides answers to Frequently Asked Questions about the codes on the NFPA Web site. These FAQ's are available free of charge.

NFPA will be issuing the first edition of the NFPA 5000 Handbook in November of 2003. This handbook will give added examples and cite some of the background information for application of the various code requirements. Other reference materials also are under consideration.

A - 9.b. NFPA is in the process of finalizing a partnership with IAPMO for the creation and operation of a product evaluation service to assess the ability of technologies and products to meet requirements included in NFPA 5000. IAPMO Research and Testing and IAPMO Testing and Services have been a major source for independent testing, research, and technical services for a wide variety of construction related products. IAPMO reports are utilized in dealings with jurisdictions including the City of Los Angeles, California Energy Commission, and others.

A - 9.c. NFPA currently provides a number of certification programs, including: Fire Inspector I, Fire Inspector II, Fire Plans Examiner, Certified Fire Protection Specialist, Certified Building Inspector, and Certified Building Plans Examiner. NFPA is currently in the process of developing a Certified Building Official program, as well as a Residential Electrical Inspector, and Master Electrical Inspector program.

NFPA allows transfers into these programs for persons currently certified under other reputable certification programs. This allowance is intended to give credit to the work already completed in an existing program. Doing so allows renewal into the NFPA certification program without the need of retaking the examination.

In general, the testing programs for these certification programs include a four-hour, open-book exam that consists of approximately 100 multiple-choice questions. The exam asks participants to recall specific information, apply knowledge to new or changing situations, and analyze facts to determine solutions.

Recertification is required every three years, and applicants must submit documented evidence of a total of 50 – 60 (depending on the program) professional development credit points from the following categories:

- Training
- Instruction
- Professional practice
- Publications
- Membership in professional organizations

The U.S. Department of Veterans Affairs has approved the CFPS, CFI, and CFPE Certification Programs for reimbursement of examination fees.

Additionally, NFPA develops and promulgates standards for professional qualifications that are recognized by many other organizations. These professional qualifications standards include firefighter qualifications, fire inspector, and electrical inspector qualifications.

10. Please provide a list of referenced publications that may be required in order to plan review an acute care hospital, skilled nursing facility, licensed clinic, and/or correctional treatment center. Please provide a separate, comprehensive list (not a reference to a portion of the model code). Please provide an estimate of the cost to purchase the required referenced publications.

A. If such a facility is to be eligible for Medicare and Medicaid funding, it must comply with the provisions of the NFPA 101, *Life Safety Code* as required by federal law. Though NFPA 101 is not specifically adopted and enforced by the State of California, it is a reality for acute care hospitals, skilled nursing facilities, licensed clinics, and correctional treatment centers located throughout the state. NFPA 5000 is the only model building code that is closely correlated with NFPA 101. Adoption of NFPA 5000 offers such California facilities not only the possibility for fewer conflicts between NFPA 101 and the next California Building Code, but also considerable cost savings for the facilities.

The vast majority of the non-NFPA publications listed in Section 2.3 will not be needed for plan review purposes. Exceptions might include documents such as:

(a) ACI 318, *Building Code Requirements for Structural Concrete*
(b) ACI 530/ASCE 5/TMS402, *Building Code Requirements for Masonry Structures*
(c) AF&PA ASC & LRFD
(d) AISC ASD & LRFD
(e) AISC Seismic, *Seismic Provisions for Structural Steel Buildings*
(f) AISI-NASPEC, *North American Specification for the Design of Cold-Formed Steel Structural Members*
(g) ASCE 3, *Standard for the Structural Design of Composite Slabs*
(h) ASCE 7, *Minimum Design Loads for Buildings and Other Structures*
(i) ASCE 8, *Standard Specification for the Design of Cold-Formed Stainless Steel Structural Members*
(j) ASCE 19, *Structural Applications of Steel Cables for Buildings*
(k) ASCE 24, *Flood Resistant Design and Construction*
(l) ASHRAE 62, *Ventilation for Acceptable Indoor Air Quality*
(m) ASHRAE 90.1, *Energy Standard for Buildings Except Low Rise Residential Buildings*
(n) ASHRAE 90.2, *Energy-Efficient Design of Low-Rise Residential Buildings*
(o) ASME A17.1, *Safety Code for Elevators and Escalators*
(p) ICC/ANSI A117.1, *American National Standard for Accessible and Usable Buildings and Facilities*
(q) SJI, *Standard Specifications, Load Tables and Weight Tables for Steel Joists and Joist Girders*

(r) *Uniform Mechanical Code*
(s) *Uniform Plumbing Code*

It is important to note that these standards are also referenced in the IBC and must be used with that document, since they are also considered part of that building code.

NFPA has not calculated the cost of these other standards. However, NFPA offers free training and associated code books to support statewide adoption of its building code. Since NFPA 5000 also references other NFPA codes and standards, those major NFPA standards will be made available free of charge to code enforcers who attend NFPA's complimentary training sessions.

11. Please provide a list of referenced publications that may be required in order to field review construction of an acute care hospital, skilled nursing facility, licensed clinic, and/or correctional treatment center. Please provide a separate, comprehensive list (not a reference to a portion of the model code). Please provide an estimate of the cost to purchase the required referenced publications.

A. Field reviewers are expected to have the rudimentary skills outlined for plan reviewers in item 10 above. NFPA 5000, the referenced NFPA codes and standards, and ICC/ANSI A117.1 should suffice for field review. The NFPA documents will be provided free of charge to code enforcers who attend the free training sessions offered by NFPA to support statewide adoption of NFPA 5000, as indicated above. A copy of ICC/ANSI A117.1 is currently $25.

Response by the International Code Council to Questions from the California Office of Statewide Health Planning and Development (OSHPD)

June 2, 2003

Questions Related to Structural Provisions

1. Describe the acceptance criteria used to select referenced publications for the code.
a. Are there standards for style and format?
b. What criteria are used to determine enforceability of the referenced publications?
c. Is the participation of enforcement agencies in the development of the referenced publications a consideration?
d. How are the issues of referenced publication cost, availability, and policies on updates and errata considered?

The ICC has an "ICC Code Development Process" that describes the requirements in order for a standard to be considered for reference or to continue to be referenced by the ICC family of codes. Section 3.6 in that document, provided as an attachment to this response, addresses the criteria covering this subject. There are no requirements for a particular style or format of text presentation and there is no specific requirement that the standard development committee have voting membership for those that enforce the standard themselves. The reason being that a true consensus process would include a number of those enforcers to maintain a proper balance and to get the view of those who have to deal with its contents daily. The ICC is very concerned about the affordability of referenced standards and has an Ad Hoc Committee on the Use of Referenced Standards well underway. This group is intended to review the current usage of standards in the ICC codes and make recommendations as to the usefulness of the standard and how its information should be provided.

2. Describe the methods used to review referenced publications cited in the structural chapters, prior to adoption into the code.
a. What process is used to evaluate and amend the referenced publications?
b. How many individuals review each publication?
c. How much time is allotted to the effort?
d. Is there a written public record of the findings and recommendations of the reviewers?

The ICC code change process is used to evaluate the inclusion of a new or update to an existing reference document. Staff reviews a code change proposal that contains a referenced standard and sufficient copies of the standard must be provided to the ICC committee responsible for the applicable code for them to evaluate. The staff secretariat first reviews the standard for compliance with the

ICC criteria for referenced standards contained in the procedures mentioned above under question 1. The proponent of the code change with the referenced standard must make their case for adoption and use of the standard before the applicable committee(s) at the code change hearings. As such the staff, applicable ICC committee(s) and any and all interested and affected parties who choose to would review each publication and the context within which it would be referenced in the subject code. Staff would typically have 6 months from submittal to the first code hearing to review all proposed code changes. The committee would be provided those changes and relevant documentation about 3 months before the first code hearing and all code changes are published for public review at least 2 months before the first code hearing. These dates establish some starting point for review of these documents. The amount of time expended by the staff, committee and interested parties on the review of each related change cannot be estimated precisely. Experience shows it to be significant.

It should also be pointed out that ICC staff and jurisdictional members also monitor or participate in the efforts of many standards committees. For instance ICC staff is involved with ASCE 24 and recently attended their last meeting in St. Louis in mid-May 2003. Such involvement ensures, among other things, that if and when revisions to standards referenced in the codes are submitted for consideration ICC staff is fully able to address their potential application in the I-Codes. The results of the staff review of standards with respect to their conformance to the ICC procedures for reference standards are published with the applicable code change in the monograph containing all code changes that is part of the public record.

3. Identify and describe the duties of the individuals responsible for coordinating referenced publications.
a. How is the scope of the referenced publications (as applied in the code) determined?
b. What is the process for identifying and remedying conflicts?
c. How many individuals review the referenced publications for potential conflicts?
d. What are the criteria used to judge compatibility of the referenced publications with other structural requirements of the code?

The ICC Correlation Committee handles the coordination of ICC codes. This committee meets after the final outcome of the code development cycle to hear and resolve any conflicting actions. This is handled by the Manager of Codes who compiles the information for committee review. The original code committee, staff, audience, members in attendance at the Final Action Hearing and the Correlation Committee all verify the coordination of the provisions and each plays a vital role in the publication of coordinated codes. Of note each I-Code does contain a provision that establishes an order of priority. Where

differences occur between the code and a referenced standard the provisions of the code take precedence.

4. Reference publications produced by the steel, concrete, masonry, and timber industries are valuable resources. However, they also reflect the bias of the industry group, and may include structural systems or methods of construction suitable only for areas of low seismic risk. What processes are used to screen the referenced publications to ensure systems of low ductility are not constructed in regions of high seismic risk?

Pursuant to the ICC procedures related to reference standards, standards and other documents referenced in the I-Codes must have been developed via a consensus process such as prescribed by ANSI or ASTM. Because those processes provide for balance of interested and affected parties it is not possible under the ICC procedures for a standard or other document as described above to find its way into the I-Codes, unless it were developed via a consensus process. If developed through such a process the probability that any one industry group could bias the standard is very remote and if they did the process is such that those adversely affected industries would likely appeal to the standards developer and surely make their views known should the standard or other document find its way into the ICC code change process.

With respect to the seismic-related portion of the question, the provisions that require certain structural systems over another in particular seismic hazard areas are usually not found in the standards produced by industry but rather in the provisions that come from the National Earthquake Hazard Reduction Program (NEHRP). This group was set up specifically to address the creation of a national set of criteria to reduce damage to buildings due to earthquakes. This group has a number of representatives that do include code officials and structural engineers. There have been representatives from California on the committees involved with this group in the past. The members of ICC are assured that the concerns over the use of many types of construction are addressed through this Federal activity. If derived from industry documents the checks and balances previously described above would ensure that the subject document was not referenced in the I-Codes.

5. The relationship in Chapter 16 between the IBC seismic provisions and ASCE 7 is very confusing. The IBC directs the user to ASCE 7 for specific aspects of the design.

5.1. To what extent does this direction supplant the IBC provisions?

Section 102.4 of the IBC states that the codes and standards referenced in the IBC are to be considered part of the code to the prescribed extent of each reference and where differences occur between provisions of the code and referenced standards, the provisions of the code apply. Based on this section,

whenever Chapter 16 of the IBC references a specific section of ASCE 7, the provisions of ASCE 7 must be followed. If there were specific provisions in ASCE 7 that are in conflict with provisions in the IBC, the provisions of the code would apply.

5.2. For example, building irregularity is checked using ASCE 7, Section 9.5.2.3. This procedure requires that the forces used shall be those in ASCE 7, Section 9.5.5. Does this mean that the forces in ASCE 7 Section 9.5.5 supercede those in the corresponding section of the IBC, should they differ?

Section 1616.5 of the IBC requires that buildings be classified as regular or irregular based on the criteria prescribed in Section 9.5.2.3 of ASCE 7. As for determination of forces using the equivalent lateral force procedure, Section 1617.4 of the IBC has no specific provisions but references Section 9.5.5 of ASCE 7 for determination of forces using the equivalent lateral force procedure.

5.3. Similar issues occur in the nonstructural and nonbuilding structure sections. For example, QA requirements for nonstructural components are part of ASCE 7, Section 9.6, which is referenced in IBC Section 1621. Do the ASCE 7 QA requirements supercede parallel (but different) requirements in Chapter 17?

Section 1621.1 of the IBC specifically references Section 9.6 of ASCE 7 with some modifications as indicated in the IBC. An integral part of Section 9.6 of ASCE 7 is Section 9.6.1.7 on construction documents, which is not modified in the IBC. Section 9.6.1.7 of ASCE 7 refers to Table 9.6.1.7, which in turn references Appendix A.9.3 for quality assurance. Therefore, the provisions of Appendix A.9.3 of ASCE 7 do apply to quality assurance requirements for architectural, mechanical and electrical components and systems.

6. The IBC seismic provisions eliminated the requirement that the Seismic Design Category (SDC) be based on the more restrictive of the requirements for short or long period structures. This means that unreinforced masonry and concrete structures may now be constructed in many areas of California, a practice outlawed since the 1930's. What technical justification of these low ductility systems was provided, showing they provide sufficient safety?

The elimination of the requirement that the Seismic Design Category be based on the more restrictive of the short and long period design spectral accelerations includes several restrictions. In order to use the exception, all of the following must be met: (1) the approximate fundamental period of the structure, T_a, in each of the two orthogonal directions must be less than $0.8T_s$, (2) equation 9.5.5.2.1-1 of ASCE 7 (short period structure base shear) must be used to determine the seismic response coefficient, Cs, and (3) the diaphragms must be rigid as defined in Section 1602 of the IBC.

The technical justification for the exception (code change proposal S39-02) in Section 1616.3 of the 2003 IBC was that under the 2000 IBC (1997 NEHRP) provisions, short period buildings ($T_a < T_s$) may be unfairly penalized by having their Seismic Design Category controlled by the long period MCE ground motion (S_1) or design spectral response acceleration (S_{DS}) even though the structure only responds in the short period, acceleration controlled domain of the spectrum. The 0.8 factor was included to ensure that $T < T_s$ in order to provide some margin that would prevent excursions into the long period, velocity-controlled range. The requirement that equation 9.5.5.2.1-1 of ASCE 7 be used is redundant because the base shear of structures with $T_a < 0.8T_s$ is already governed by the short period portion of the response spectrum. The requirement that diaphragms be rigid was a modification made by the code change committee in response to concerns by the BSSC CRSC, so this additional restriction was added to ensure that the exception only apply to rigid structures that are less likely to experience period elongation. The ICC record of the code change cycle under which the 2003 IBC was developed indicates that code change S39-02 as modified had the support of both the BSSC CRSC and the BSSC TS-2 committee.

The ICC believes that the real issue here is that under the 2003 IBC it is possible to have buildings in California that are classified in Seismic Design Category C or even B, depending on Site Class. The issue with the new exception to Section 1616.3 in the 2003 IBC is that there are regions in the central valley that would have the Seismic Design Category controlled by the long period ground motion, and it is possible to have buildings in California that are classified in Seismic Design Category C or even B, depending on Site Class. [With respect to Site Class, under the 2000 IBC, for Site Class B soil ($F_a = 1.0$, $F_v = 1.0$), which is the best soil possible for the west coast, in order for $S_{DS} < 0.33g$ and $S_{D1} < 0.133g$ corresponding to Seismic Design Category B (for Seismic Use Group I & II), the MCE ground motion would have to be $S_S < 0.50g$ and $S_1 < 0.20g$. Based on the USGS maps and IBC Figures 1615(3) and 1615(4), there are regions of central California with $S_S < 0.50g$ and $S_1 < 0.20g$. Under the 2003 IBC, buildings that meet the exception to Section 1616.3 need only meet $S_{DS} < 0.33g$ in order to be in Seismic Design Category B (for Seismic Use Group I & II). Under the exception, it is possible to have buildings on Site Class C soil and be in Seismic Design Category B. In this case the MCE ground motion would have to be $S_S < 0.42g$. Based on the USGS maps and Figure 1615(3) of the IBC, there are some regions of central California with $S_S < 0.42g$.]

Under the IBC, buildings in Seismic Design Category B would be permitted to be constructed with ordinary concrete moment frames, ordinary plain concrete shear walls, ordinary plain masonry shear walls, and ordinary plain prestressed masonry shear walls. Buildings in Seismic Design Category C would be permitted to be constructed with intermediate concrete moment frames, detailed plain concrete shear walls, ordinary reinforced masonry shear walls, and intermediate prestressed masonry shear walls. Historically these types of

construction have not been permitted in California under the UBC because California is in either Seismic Zone 3 or 4.

This issue could be mitigated by the state agencies (DSA/HCD/OSHPD) through the state amendment process, and the Building Standards Commission could make an amendment for state owned buildings not otherwise regulated by state agencies. However, at the present time there is apparently no way to make a global amendment that affects all occupancies. This is something that would have to be done either by jurisdictions at the local level or via legislation at the state level.

7. If a referenced publication in turn references other documents, are these documents also considered to be a part of the building code? If not how is the referenced publication to be enforced?

The IBC sometimes references different editions of material standards than those in ASCE 7-02. For example, IBC references ACI 530-02 for masonry design, while ASCE 7-02 is based on ACI 530-99. Similarly, IBC references AISC Seismic Provisions for Structural Steel Buildings 2002, while ASCE 7-02 is based on AISC Seismic 97, with Supplement 2. Where there are technical differences, which edition of the material reference is enforced? If a version of a standard different from that specified in ASCE 7-02 is enforced, what steps have been taken to ensure that compatibility in design assumptions between ASCE 7 and the material standard is maintained?

If a standard that is referenced by the code in turn references another standard, then that second standard is considered to be referenced by the code. Was this not the case, there would not be a complete "chain" of provisions. If any were found to be non-compliant with ICC rules for referenced standards the code change proposal to reference that standard would be addressed as discussed above under question 2. A good example is Section 1903.6 of the 2003 IBC. This section references Section 3.6 of ACI 318. Subsection 3.6.5 of ACI 318 references ASTM C 494 and ASTM C 1017. The 2003 IBC does not make direct reference to either ASTM C 494 or ASTM C 1017, but they are indirectly referenced by the reference to Section 3.6 of ACI 318 in Section 1903.6 of the 2003 IBC. In this situation the designer must comply with the ASTM standards and therefore they too are considered an extension of the code.

With respect to the example above concerning ASCE 7, if such conflicts are known to currently exist then they should be identified to ICC staff who will notify the ICC Correlation Committee or the appropriate ICC Code Council. If there is an issue with various referenced editions of the same standard in the ICC codes, the Ad Hoc Committee on the Use of Referenced Standards would look at those standards to see if a revision to the code needs to be made. It must be noted that at times in the past, a code change proponent and the membership have agreed to use an older edition of a given standard for peculiar reasons.

8. Describe the services that ICC currently provides to enforcement agencies for code support.
a. Does ICC provide interpretation services for questions on the referenced publications?
b. Does ICC currently provide product evaluation services?
c. Does ICC currently provide certification programs for inspectors, special inspectors, and plan reviewers?
d. If so, please identify each type of testing and certification program.

The ICC provides interpretation services, product evaluation services, and certification programs for personnel. These are described below.

Interpretations

The ICC offers three types of interpretations: telephone, written staff and formal published interpretations. Over 100,000 telephone interpretations are provided each year. An informal written staff interpretation can be developed and would go through an internal peer review before being sent to the requesting party. Over 5,000 written interpretations are issued each year that are a formal, published position of the ICC that would be developed with staff support through an ICC Interpretation Committee.

Turnaround time for a phone-in interpretation is in the order of hours. A written staff interpretation request receives a response in five days for a single response. More complicated responses will understandably take more time and the customer is notified of such. Request for a formal published position takes a couple of weeks.

The code interpretation policy of ICC outlined above is essentially the same as that previously offered to those in California by ICBO. These services are available free of charge to jurisdictions (e.g. enforcement agency staff) that have adopted the I-Codes. The ICC also offers free telephone and email code opinion services to ICC members. As both a member and an enforcement agency, staff of the CA OSHPD would be provided these services at not charge.

Evaluation Services

The ICC-ES currently provides a product evaluation program for use by enforcement agency staffs to ascertain code conformance of products with the 2003 I-Codes (and other codes the applicant would like addressed by the evaluation report) as described in materials attached to this response.

The process starts with an application and fees being filed by an individual or company seeking recognition of a material, product, component or assembly, hereafter called product. If the product is deemed to be fully regulated by the

code, the supporting data submitted by the applicant is reviewed by staff engineers to determine whether adequate justification has been submitted to make this determination. A key element for any test data submitted is that it must be generated by an approved laboratory. The ICC-ES definition of this is that the laboratory must be accredited, for the tests they have conducted, by an accreditation body which can trace its recognition to the International Laboratory Accreditation Cooperation, the international body for accreditation. International Accreditation Service (IAS), a subsidiary corporation of ICC, is one of three current domestic accreditation bodies that have this recognition. When the staff engineer has been satisfied that the data submitted justifies compliance with the appropriate 2003 International Code, a draft of the report is prepared for approval by the ICC-ES Evaluation Committee. Subsequent applications under the criteria are processed and released by the ICC-ES staff based on the Committee's earlier input.

Where the product is not addressed or adequately addressed by the code to assure fairness in issuing multiple evaluation reports on a product, an acceptance criteria is developed for consideration and approval by the ICC-ES Evaluation Committee which is composed of code officials whose only interest is public safety. The acceptance criteria, upon approval by the Committee, is then used as the basis of review by the ICC-ES staff as described in the previous paragraph.

The acceptance criteria process starts with discussions between the applicant and the ICC-ES project engineer to determine what type of recognition the applicant seeks under the I-Code and legacy codes, if any are being sought. The project engineer then develops a proposed acceptance criteria to determine compliance with the code. For innovative construction not addressed by the code, compliance is determined under Section 104.11 of the IBC. (Alternative materials, design and methods of construction and equipment). In the process of developing the proposed document, the engineer may consult with independent experts in the appropriate field.

Upon completion of the proposed document, a notice for a public hearing before the Evaluation Committee is announced at least one month before the hearing date. The notice is sent to all known interested parties as well as being posted on the ICC-ES web site. The proposed document is available for downloading on the web site at that time. At the hearing, all written comments submitted earlier and verbal comments at the hearing are evaluated by the ICC-ES staff and Evaluation Committee. Several iterations of this process may be necessary before the Evaluation Committee is satisfied that the document meets the needs of the code official under the appropriate codes. The approved acceptance criteria are then posted on the ICC-ES web site for review and use by any interested party concerning compliance with the I-Codes and legacy codes. The open process provides the basis of receiving the most recent technology

available on the subject, and establishes a uniform and equitable basis for recognition of competitive products.

Evaluation of some fairly simple and basic products fall between what is required by acceptance criteria and specific code requirements. Where there is no imminent threat to public safety, these types of products can be reviewed after an "evaluation guideline" is developed. This document is a published policy for evaluation reports developed by the ICC-ES staff. The guideline is placed on the ICC-ES web site where comments from interested parties are solicited. The final document is approved by the Evaluation Committee without a formal public hearing as for acceptance criteria. However, if there be concerns expressed by the Committee or interested parties, guidelines are declared acceptance criteria, requiring that the public process be followed.

All applicants for products recognized in ICC-ES reports must be under a manufacturing or fabrication quality control program. Where listing is required by the code, an inspection agency administers the program. Any inspection agency doing this work must be approved by ICC-ES. Since there is no international agreement for accreditation of inspection agencies, IAS accreditation is predominately used as the basis of approval provided it is in the field of expertise necessary. Where listing is not required by the code, ICC-ES reviews the quality control manuals and performs an initial inspection of the facility. Thereafter it monitors the product through its reexamination process every year or two years, with onsite inspections as necessary.

One of the appropriate processes described above is repeated when technical changes or additions to the report require revisions to acceptance criteria or evaluation guidelines.

<u>Personnel Certification</u>

During the past three decades, the ICC - through its predecessor Model Code Organizations - has developed the nation's most robust and prestigious professional certification credentials for the code administration professions. Through the ICC, nationally recognized certifications are available for 54 different code administration professions, including residential and commercial inspector, permit technician, plans examiner, special inspector, and building official. A complete listing of these programs has been provided to DSA as an attachment to this response. Additional information on these programs is also available on the ICC web site.

Nearly 70,000 individuals hold "current" certification through ICC, with these certificates maintained on a triennial basis through re-examination or professional development activities. ICC certification is recognized by most of the states which license or otherwise regulate code administrators, including California (AB 717).

9. Please provide a list of referenced publications that may be required in order to plan review an acute care hospital, skilled nursing facility, licensed clinic, and/or correctional treatment center. Please provide a separate, comprehensive list (not a reference to a portion of the model code). Please provide an estimate of the cost to purchase the required referenced publications.

The following is a list of key structural standards that may be required for design and plan review for the types of buildings listed above. Depending on the scope of the project, additional standards may be required. In addition, some of these standards may serve as reference documents.

1. *ASCE 7-02*
2. *ACI 318-02*
3. *AF&PA NDS -2001 (ASD)*
4. *AF&PA/ASCE 16-95 (LRFD) (If applicable)*
5. *ACI 530-02/ASCE 5-02/TMS 402-02*
6. *AISC ASD 1989 & Supplement No. 1 (2001)*
7. *AISC LRFD 1999*
8. *AISC HSS 2000*
9. *NASPEC 2001 (Formerly AISI)*
10. *AISC Seismic 2002*
11. *IBC-ASTM Book of Standards (Contains all ASTM Standards referenced in IBC Chapter 35)*
12. *ASCE 24-98: Flood Resistant Design and Construction*
13. *AWS D1.1-2000: Structural Welding Code-Steel*
14. *AWS D1.3-98: Structural Welding Code-Sheet Steel*
15. *AWS D1.4-98: Structural Welding Code-Reinforcing Steel*

The costs to obtain the aforementioned standards will vary depending on whether the jurisdiction is a member of a particular standard developing organization and on the quantity of each standard purchase. An approximate cost based on single unit member pricing would range between $1,000 and $1,100 and takes into account the savings from purchasing the IBC-ASTM Book of Standards, versus purchasing each ASTM standard separately. If this document were not available through ICC the cost to procure separate copies of those ASTM standards would be considerably more.

10. Please provide a list of referenced publications that may be required in order to field review construction of an acute care hospital, skilled nursing facility, licensed clinic, and/or correctional treatment center. Please provide a separate, comprehensive list (not a reference to a portion of the model code). Please provide an estimate of the cost to purchase the required referenced publications.

The following is a list of key reference standards that may be required for field inspection for the types of buildings listed above. Depending on the scope of the

project, additional standards may be required. In addition, some of these standards may serve as reference documents.

1. *ACI 318-02*
2. *ACI 530-02/ASCE 5-02/TMS 402-02*
3. *AISC ASD 1989 & Supplement No. 1 (2001)*
4. *AISC LRFD 1999*
5. *AISC HSS 2000*
6. *NASPEC 2001 (Formerly AISI)*
7. *IBC-ASTM Book of Standards (Contains all ASTM Standards referenced in IBC Chapter 35)*
8. *AWS D1.1-2000: Structural Welding Code-Steel*
9. *AWS D1.3-98: Structural Welding Code-Sheet Steel*
10. *AWS D1.4-98: Structural Welding Code-Reinforcing Steel*
11. *AF&PA NDS -2001 (ASD)*

The costs to obtain the aforementioned standards will vary depending on whether the jurisdiction is a member of a particular Standard Developing Organization or based on the quantity of each standard purchase. An approximate costs based on single unit member pricing would range between $770.00 and $870.00 and takes into account the savings from purchasing the IBC-ASTM Book of Standards, versus purchasing each standard separately.

Questions Related to Fire and Life Safety Provisions

1. Application of a consistent code throughout the country is an important consideration. To date, what state and local jurisdictions have adopted the International Building Code?

A list that identifies the state and local adoption status of all I-Codes is provided as an attachment to this response. At the Federal level I-Codes have been referenced and recognized by the CPSC, DOE, DoD, FEMA, GSA, HUD and OMB.

2. The IBC allows heights and areas that are much larger than what has historically been allowed in the UBC and CBC. What justification was provided to increase the allowable heights and areas so drastically?

The allowable heights and areas are an increase over what was found in the 1997 UBC. The committee that prepared an initial draft of an IBC, in reviewing all of the heights and areas that were used in the model codes at that time, found that to do a proper review a close look at the impacts of these values had to be done considering both new construction and construction on existing buildings. It was found that the values from more restrictive tables did not necessarily adversely affect the construction of a new building since during the conceptual and design stages such areas could be accounted for in the design and

continued use of the building. However, in existing construction, there were many instances of restrictive values imposing a limitation on the uses that could be placed within a given structure or on any planned addition to such building. This is due to the construction of a structure under a previous code that may have allowed an additional amount of area that would be expected to be used when needed. More restrictive areas, in particular, could cause the planned work to be abandoned as a result.

That drafting committee also investigated the information available on fire losses related to building size. Such data was not found nor was it provided to the committee by anyone in attendance. To date, ICC is very interested in any such information that can be related to this topic and continues to encourage anyone to forward such information to Paul Armstrong at the ICC office in Whittier, CA.

3. The IBC offers substantial "trade-offs" in construction for automatic sprinkler systems. It is very likely that an earthquake may render such sprinkler systems inoperative in areas of high seismic activity. Additionally, sprinkler systems may be shut off for maintenance or service. How are buildings protected against fire, where sprinkler systems are used for trade-offs and then fail to operate when needed?

The issue is really the performance of any such fire protection before, during and after a fire, earthquake or any such event. The building code provisions intend that any such fire protection be in place and functional when and if such an event should occur. As with the World Trade Center collapse, the issue is also with passive fire protection as well as active suppression. The codes are set up to ensure that such fire protection if designed, constructed and maintained properly will perform in the manner intended. This is reflected in the excellent fire loss records of sprinklered office buildings. The building code works together with the fire code among others to ensure the continued operation of such systems. It is when the proper maintenance of both active and passive fire protection systems is not done, that such problems can arise.

4. UBC section 302.1, exception 2.4 allows a kitchen not to be separated from the dining area of which it is a part. Is this allowed in the IBC? If so, where?

The IBC handles this in the Occupancy classification of restaurants themselves. The Group A, Division 2 Occupancy classification includes the kitchens that are a part of the assembly use In Section 303.1 of the IBC.

5. Sprinkler requirements for Group I occupancies are confusing and/or contradictory. Section 903.2.5 requires sprinklers *throughout buildings with a Group I fire area*. Table 903.2.13 (2003 IBC draft) refers to section 407.5 for "additional required suppression systems." Section 407.5 requires sprinklers *throughout smoke compartments containing patient sleeping rooms* in I-2 occupancies. Are sprinklers required throughout buildings, or only in smoke

compartments containing sleeping rooms in hospitals? Do fire walls create separate buildings for the purpose of fire sprinklers? (Section 903.2.5 requires sprinklers “throughout buildings,” and section 705.1 says that portions of buildings separated by fire walls shall be considered separate buildings. Are sprinklers allowed to stop at the fire wall?)

The sprinkler requirements found in Section 903.2.5 of the IBC set out the general rule that throughout all buildings containing such uses an automatic sprinkler system must be installed. Table 903.2.13 of the IBC then provides additional requirements and, for these uses, sends the user to Section 407.5 of the IBC. The first sentence in Section 407.5 is redundant as it requires the sprinkler system in the patient sleeping area, but is necessary to set the stage for the second sentence. The second sentence then follows with the additional requirement of the quick response or residential sprinklers in the patient sleeping area. As for the fire wall in the IBC creating separate buildings for sprinkler requirements, it is true. They are then separate buildings and as such would not be provided with an automatic sprinkler system unless required to do so by another provision of the code. Interestingly, the 1997 UBC only required the sprinkler system to be in the Group I Occupancy portion of the hospital itself; not throughout the entire building containing the use.

EVALUATION OF THE 2003 MODEL BUILDING CODES

Office of Statewide Health Planning and Development
Facilities Development Division

Overview

- **Evaluation Approach and Process**
- **OSHPD Review Team**
- **Overview of the Findings of the OSHPD Evaluation**
- **Summary**
- **Conclusion**

Introduction

- The purpose of the model building code is to provide for public safety, through an efficient, usable, and consistent set of rules for construction
  - The building code is not a design manual or a guide
- Model codes represent the minimum enforceable standards
- OSHPD must amend model codes to meet its statutory requirements
  - OSHPD amendments are safety-related
- OSHPD has jurisdiction over Hospitals, Skilled Nursing Facilities, Correctional Treatment Centers, and Licensed Clinics

Evaluation Approach

OSHPD has…

- Reviewed the level of safety for both *IBC* and *NFPA 5000*
- Evaluated work needed to amend the codes
- Evaluated ease of use of the two model codes
  - Design
  - Plan review
  - Construction inspection
- OSHPD did not find the code development process relevant to the Evaluation

Evaluation Process

- Performed a comparative review of the two model codes and the *2001 CBC*
- Participated in the evaluation of codes in SFM's Operation Code Comparison
- Attended training presented by NFPA and ICC
- Reviewed code evaluation criteria suggested by interested parties
- Attended public meetings
- Reviewed code comparisons, summaries, and recommendations
- Requested clarification from NFPA and ICC

Evaluation Process

- Experienced, multi-disciplined team participated in the evaluation process, including:
  - Architects
  - Fire/Life Safety Officers
  - Mechanical engineers
  - Structural Engineers
- Review encompassed all aspects of the building code, including fire and life safety provisions promulgated by the State Fire Marshal and enforced by OSHPD

OSHPD Review Team

Susan Botelho – Staff Services Manager III

- **Chief, Regulations Development Section**
- **Past President, California Capitol Chapter, ICBO**

Byron "BJ" Foster – Fire/Life Safety Officer

- **Member of the NFPA 5000 Height and Area Committee**

Tom Hale – Senior Structural Engineer

- **Co-chair of the SEAOC Central Seismology Committee**
- **Past-chair of the State SEAOC Seismology Committee**
- **Member of the BSSC/NEHRP 2003 Provisions Technical Subcommittees TS-3 Foundations and Geotechnical Considerations, and TS-12 Base Isolation and Energy Dissipation.**

OSHPD Review Team

John Gillengerten – Senior Structural Engineer

- **Member, Provisions Update Committee (PUC), BSSC/NEHRP Provisions 1994-present**
- **Chairman of the BSSC/NEHRP Provisions Technical Subcommittee TS-8, Nonstructural Components and Systems, 1997-present**
- **Member, ASCE 7 Task Committee on Earthquake Loads, 1998-present**
- **Member BSSC Code Resource Structural Committee (CRSC), 1997-present**
- **Member, NFPA 5000 Committee on Structures and Construction**

OSHPD Review Team

Don Harris – Senior Architect

- **Member, NFPA 5000 Committee on Health Care Occupancies**
- **Member, Code 2000 partnership egress working group**
- **Member, OSFM Code Comparison Committee**

Bill Staehlin – Supervising Structural Engineer

- **Current President, SEAOC**
- **Past President, Structural Engineers Association of Central California (SEAOCC)**
- **Member, ASCE 7 Task Committee on Earthquake Loads, 1998-present**
- **Member and past chairman of ASHRAE TC2.7 Seismic Restraint Design**

OSHPD Review Team

Chris Tokas – SB 1953 Program Manager

- **Past President, SEAOCC**
- **Member, ASCE 7 Task Committee on Earthquake Loads**
- **Past Chair, SEAOCC Seismology Committee**
- **Chair, SEAOC Seismology Committee, 2001 to present**
- **Member, International Building Code Structural Committee, 1998 - 2002**

Level of Safety

- **The level of safety provided by a code is directly proportional to the number of amendments required**
  - **The fewer amendments in a code, the greater the level of safety provided by a building constructed to that code**
- **Ease of amendment can be hampered or enhanced by format**

Code Support

- **Building code support and product evaluation services are fully in place for the IBC, and promised by NFPA**
- **NFPA has extensive experience supporting their standards, but they have no experience providing support for a building code**
- **There is insufficient data available to be able to evaluate the NFPA support services**

Fire and Life Safety Evaluation

- Performed a comprehensive review of portions of the model codes for occupancies under our jurisdiction (included fire and life safety, structural and other provisions)
- Requested clarification from code organizations related to fire and life safety issues
- Major portions of our report address fire and life safety/architectural issues

Fire and Life Safety Evaluation

- Level of protection in IBC and NFPA 5000 are substantially lower than the CBC
- In general, level of fire and life safety provided by IBC and NFPA 5000 is roughly equal.
- NFPA 5000 allows much greater height and area for licensed clinics (treated similarly to business occupancies)

Operation Code Comparison

- **OSHPD Participated in and utilized the State Fire Marshal's "Operation Code Comparison"**
- **Different conclusion from SFM**
  - **NFPA 5000 does not provide greater level of safety**
  - **Firefighter safety is addressed in both codes**
  - **4-hour rated construction for high rise can be amended by SFM is justified, but this has never been proposed in the past**

National Structural Standards

- **Structural standards are now prepared at the national level**
- **National Earthquake Hazard Reduction Program *Recommended Provisions for Seismic Regulations for New Buildings* (NEHRP *Provisions*)**
- **American Society of Civil Engineers *Minimum Design Loads for Buildings and Other Structures* (ASCE7-02)**

Reference Documents (Standards and Publications)

- Both model codes use reference documents
- IBC amends these documents for safety and consistency
- In general, NFPA 5000 has not been amended to resolve conflicts with the structural material standards
  - NFPA states that their committees have authority to amend referenced standards to resolve conflicts

Structural Materials Standards

- Different organizations publish standards for the design and use of various structural materials, for example:
  - American Concrete Institute (ACI)
    - ACI 318 – Concrete Design
    - ACI 530 – Masonry Design
  - American Iron and Steel Institute (AISI)
    - Cold-Formed Steel Specifications
  - American Institute of Steel Construction (AISC)
    - Specifications for Structural Steel Buildings

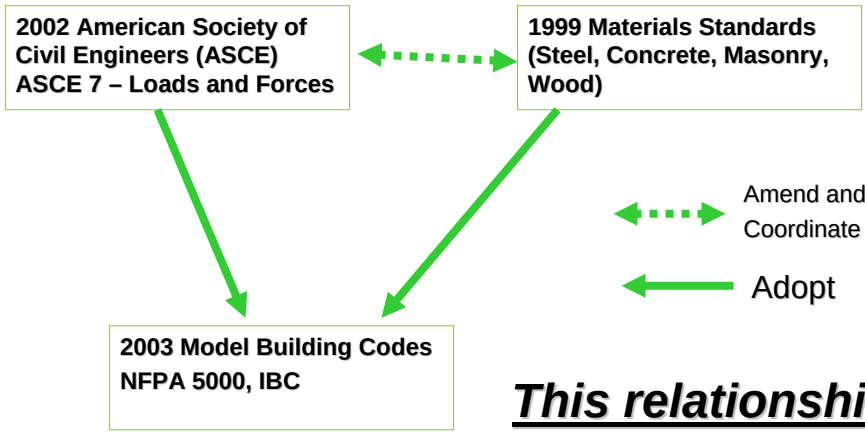
Amending Structural Reference Standards

- At the national level, material standards are considered for adoption into the NEHRP Provisions and ASCE 7
- NEHRP and ASCE both amend material standards if they are deemed inadequate
  - The amendments are found in the materials chapters of the NEHRP provisions and Section A9, "Supplemental Provisions" of ASCE 7
- Use of un-amended materials standards for seismic design may result in unsafe conditions

Structural Reference Standards and ASCE 7-02

- ASCE 7-02 (referenced by both codes) is based on the 1999 editions of the steel, concrete and masonry standards
- Both codes reference the 2002 editions of the steel, concrete and masonry standards

Ideal Relationship of Structural Standards

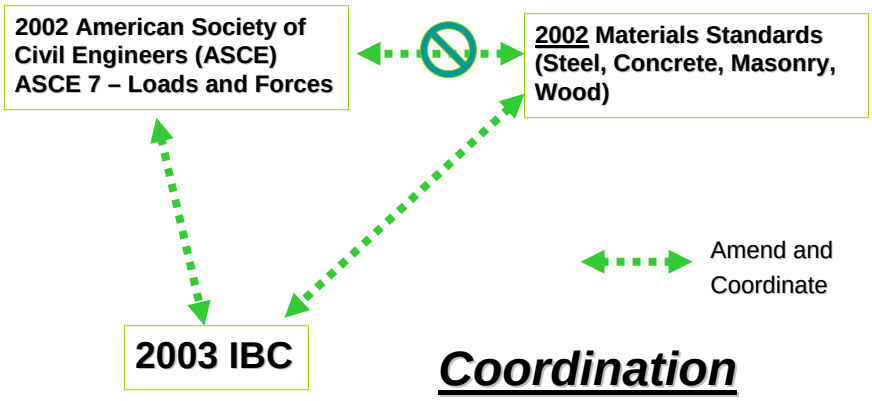


This relationship does not exist!

IBC and the Material Standards

- **IBC simply does not adopt the sections of ASCE 7-02 covering material standards**
- **Each material chapter in the IBC has been amended to coordinate the 2002 edition material standards and ASCE 7-02**

Relation of IBC and Structural Standards

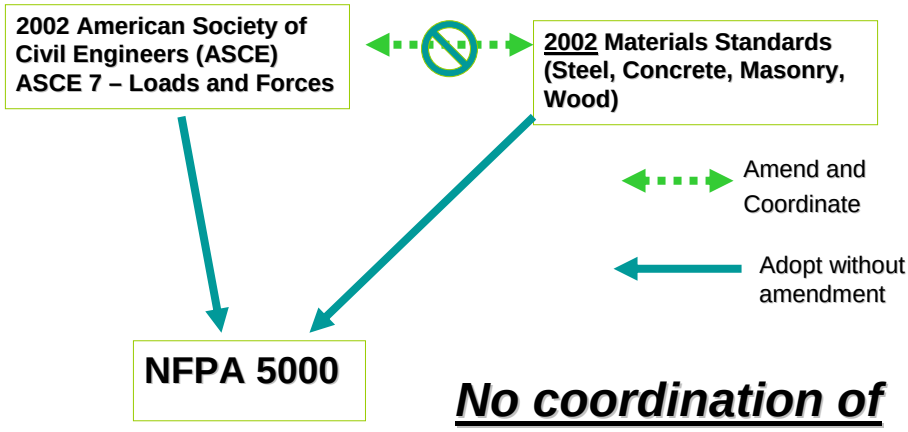


Coordination performed by ICC

NFPA 5000 and Reference Documents

- **NFPA adopts all of ASCE 7-02, but then also adopts 2002 edition material standards that conflict with ASCE 7-02**
- **No amendments were made to coordinate the 2002 editions of the material standards with ASCE 7-02**

Relation of NFPA 5000 and Structural Standards



No coordination of material standards!

Precedence of Referenced Standards and Publications

- Both ICC and NFPA were asked whether secondary and tertiary references (i.e., references in a referenced document) are valid
- ICC stated that standards referenced within another standard are valid
- NFPA initially stated that secondary and tertiary references are not valid, but subsequently reversed their position

NFPA and Conflicts Between Reference Documents

- **OSHPD posed the question:**

  "If a referenced publication in turn references other documents, are these documents also considered to be part of the building code?"

- **NFPA Response, 5/20/2003**

  "In general, secondary and tertiary references in the referenced documents are not considered to be part of the NFPA code…"

- **NFPA Comment, 6/27/2003**

  "With respect to secondary and tertiary referenced documents, NFPA 5000 Section 2.1 states "The documents or portions thereof listed in this chapter are referenced within this Code and shall be considered part of the requirements of this document". So, the provisions of a referenced standard apply."

Illustrating Code Conflicts Masonry Design and NFPA 5000

- **NFPA 5000 adopts ACI 530-02 without amendment**
- **ASCE 7-02 references ACI 530-99**
- **NFPA 5000 Section 1.3.2 states that where the requirements of a referenced code or standard differ from NFPA 5000, the requirements in NFPA 5000 shall govern**
- **Since NFPA 5000 Section 43.3 explicitly requires that masonry structures be designed in accordance with ACI 530-02, that edition must be used**

Illustrating Code Conflicts Masonry Design and NFPA 5000

- The 2002 edition, ACI 530-02 was reformatted
  - Section numbers are different from those in 1999 edition, ACI 530-99.
- Significant amendments to ACI 530-02 relating to seismic safety have been proposed for 2003 NEHRP Provisions
  - 11 Change proposals, over 35 pages long
  - These amendments will be made in ASCE 7-05

Illustrating Code Conflicts Masonry Design and NFPA 5000

- ASCE 7-02 is not coordinated with ACI 530-02
- Of 11 specific references in ASCE 7-02 to the masonry standard mandated by NFPA 5000…
  - 5 refer to sections that don't exist
  - 2 refer to incorrect sections
  - 4 are correct

Illustrating Code Conflicts Masonry Design and NFPA 5000

- **Simply correcting the section references is not enough – the other technical issues raised in the 2003 NEHRP must also be addressed**
- **This situation was raised as a question to NFPA**
- **NFPA response:**

  "It is certainly in California's best interests to adopt and enforce the most up-to-date codes and standards available. Consequently, as part of the review process, California will want to compare the seismic provisions of ACI 530-99 with ASCE 7-02's modifications to those of ACI 530-02 to determine if there are conflicts and how best to deal with those conflicts."

Masonry Design in IBC

- **No conflicts arise from the adoption of both ASCE 7-02 and ACI 530-02 in the IBC**
- **IBC does not reference ASCE 7-02, Section A9.11, (the section that references ACI 530-99).**
- **Instead, IBC Chapter 21 contains a complete set of seismic design regulations for masonry.**
  - **IBC is coordinated with the appropriate sections of ACI 530-02**
  - **IBC appears to embrace a number of the issues covered in the proposed amendments to ACI 530-02 being considered for the 2003 NEHRP provisions.**

Another Illustration
Standards versus Publications

- **NFPA uses "referenced publications" including manuals and handbooks that are not be written in an enforceable style**
- **IBC uses "referenced standards" which generally are enforceable and which IBC has amended for safety, clarity, and ease of use**
- **The hazards of adopting "publications" are illustrated by the NFPA 5000 wood chapter**

Wood Design in IBC

- **Chapter 23 of the *IBC*, covering wood construction, is a comprehensive presentation of wood design**
- **Compared to the 2001 *CBC*, the chapter is better organized, more concise, and very usable**
- ***IBC* Chapter 23 contains requirements for both engineered and conventional construction.**

Wood Design in NFPA 5000

- **There are 2 methods of design wood, Allowable Stress Design (ASD) and Load Resistance Factor Design (LRFD)**
- **In the 2001 CBC, wood frame construction is designed using the Allowable Stress Design method.**
- **The corresponding provisions in *NFPA 5000* consist of a primary reference, the American Forest Products and Paper Association (AF&PA) *Allowable Stress Design (ASD) Manual for Engineered Wood Construction*.**
- **This reference is unenforceable as written**

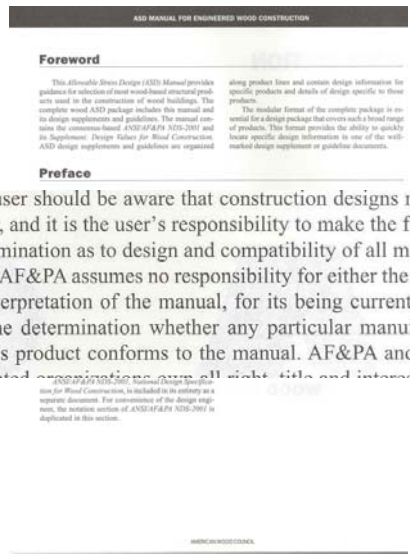
Wood Design in NFPA 5000

***ASD* manual actually consists of six documents:**

- **The manual itself**
- **2001 *National Design Specification (NDS)* for wood and NDS supplement**
- **ASD *Supplements***
- **Supplement volume *Special Design Provisions for Wind and Seismic***
- **Volume of guidelines**

Wood Design in NFPA 5000

- The AF&PA ASD Manual is the primary wood reference in NFPA 5000
- ASD Manual is intended as a reference for designers, not a code



ASD MANUAL FOR ENGINEERED WOOD CONSTRUCTION

Foreword

This *Allowable Stress Design (ASD) Manual* provides guidance for selection of most wood-based structural products used in the construction of wood buildings. The complete wood ASD package includes this manual and its design supplements and guidelines. The manual contains the consensus-based *ANSI/AF&PA NDS-2001* and its *Supplement: Design Values for Wood Construction*. ASD design supplements and guidelines are organized along product lines and contain design information for specific products and details of design specific to those products.

The modular format of the complete package is essential for a design package that covers such a broad range of products. This format provides the ability to quickly locate specific design information in one of the well-marked design supplement or guideline documents.

Preface

The user should be aware that construction designs may differ, and it is the user's responsibility to make the final determination as to design and compatibility of all materials. AF&PA assumes no responsibility for either the use or interpretation of the manual, for its being current, or for the determination whether any particular manufacturer's product conforms to the manual. AF&PA and its affiliated organizations own all right, title and interest in

ANSI/AF&PA NDS-2001, National Design Specification for Wood Construction, is included in its entirety as a separate document. For convenience of the design engineer, the notation section of *ANSI/AF&PA NDS-2001* is duplicated in this section.

AMERICAN WOOD COUNCIL

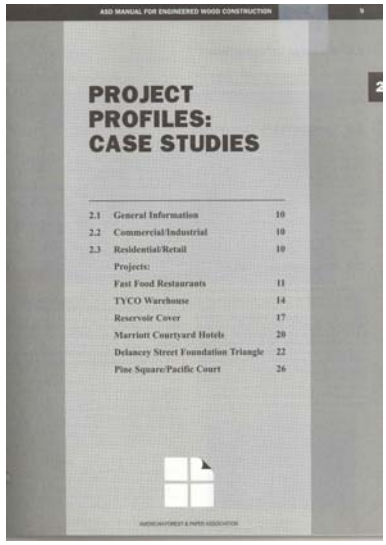
Wood Design in NFPA 5000

- The AF&PA ASD Manual States on Page 5:

  "As a first step, the authority having jurisdiction where a proposed building is to be constructed must be consulted for the requirements of the specific design project. This normally concerns the type of construction desired as well as allowable building areas and heights for each construction type."

Wood Design in NFPA 5000

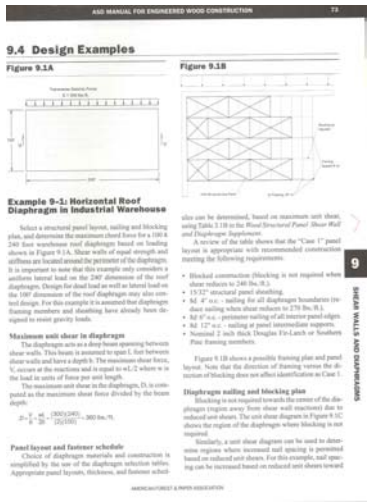
- The AF&PA ASD Manual is 98 pages long
- 20 pages are devoted to case studies that belong in a Commentary, not a building code



Wood Design

Wood Design

- 17 pages are devoted simple design examples
- 20 pages are devoted to “General Information” that is usually found in structural engineering textbooks (beam tables, material weights, etc.)
- Over one-half of the manual is clearly non-code material



ASD MANUAL FOR ENGINEERED WOOD CONSTRUCTION 73

9.4 Design Examples

Figure 9.1A

Figure 9.1B

Example 9-1: Horizontal Roof Diaphragm in Industrial Warehouse

Maximum unit shear in diaphragm

Panel layout and fastener schedule

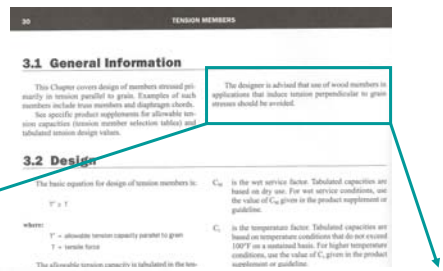
Diaphragm nailing and blocking plan

9

SHEAR WALLS AND DIAPHRAGMS

Wood Design

- The AF&PA ASD Manual is written in vague, unenforceable language

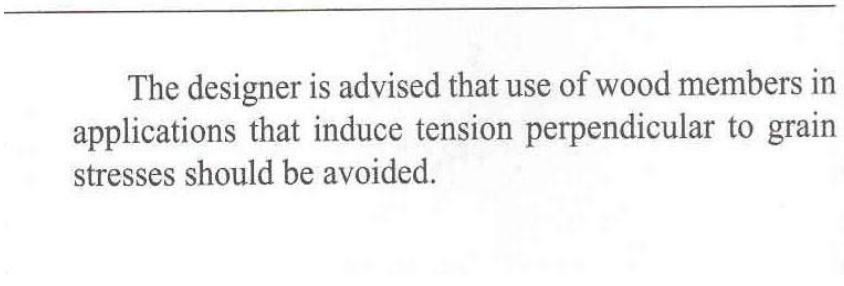


30 TENSION MEMBERS

3.1 General Information

The designer is advised that use of wood members in applications that induce tension perpendicular to grain stresses should be avoided.

3.2 Design

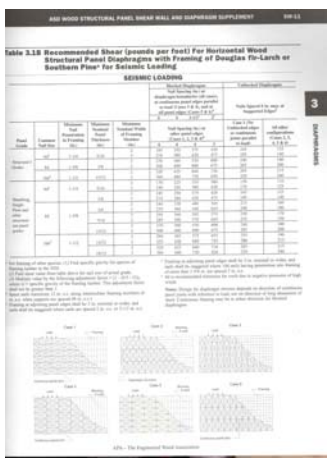


The designer is advised that use of wood members in applications that induce tension perpendicular to grain stresses should be avoided.

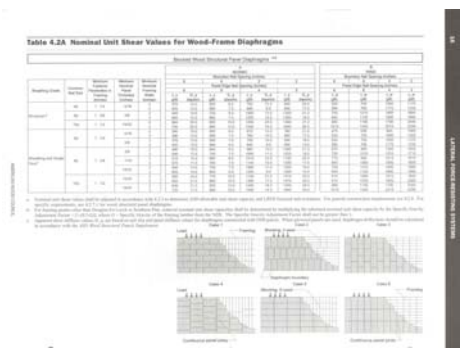
Wood Design

- ASD contains conflicting provisions in different volumes
- There are no provisions to indicate which volume take precedence
  - Shear wall and diaphragm design provisions and tables occur in two different volumes
  - The design values and procedures are different

Wood Design

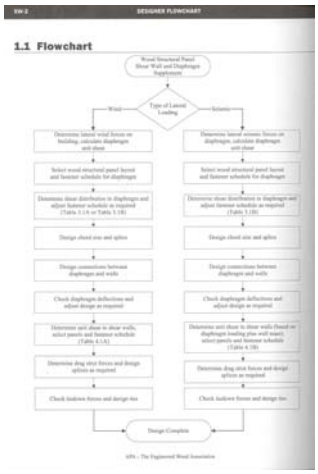


ASD *Supplement*

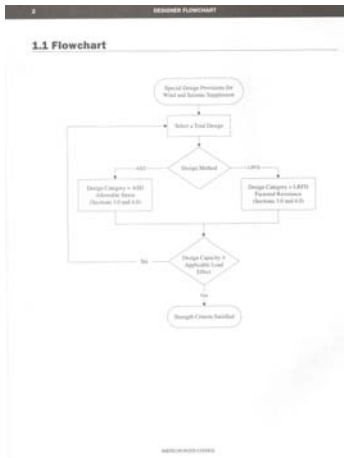


Supplement - Special Design Provisions for Wind and Seismic

Wood Design



ASD *Supplement*



Supplement - Special Design Provisions for Wind and Seismic

Another Illustration -Foundation Design in NFPA 5000

- **NFPA Soils, Foundations, and Retaining Walls Chapter is vague and incomplete**
  - **References to other documents are too broad For example,**
    - **NFPA 5000 Section 36.1.1 states that foundations must meet ASCE7-02, Sections 9 and A9.7**
    - **This is over 100 pages (the entire Seismic Design Section!)**
  - **Many important topics are not covered**

Another Illustration -Foundation Design in NFPA 5000

- **Sample provision - NFPA 5000**
  Section 36.9 Retaining Walls…

  36.9.1 Design. Retaining walls shall be designed to resist design loads in Chapter 35 and to insure stability against overturning, sliding, excessive foundation pressure, and water uplift.

References the entire structural Chapter

What is "excessive"?

Do you need a Factor of Safety?

Foundation Topics in IBC not present in NFPA 5000

Partial listing…

- **Frost Protection**
- **Footings on or adjacent to slopes**
- **Footing widths for light frame construction**
- **Design for expansive soil**
- **Pier Foundations**
- **Permissible bearing values for gravel and rock sites**

Foundation Design in 2003 IBC

IBC Soils and Foundations Chapter is an improvement over the 2001 CBC

- **For seismic design, specific requirements (and section references) are cited**
- **Example:**

  Section 1805.9 Seismic Requirements. See Section 1910 for additional requirements for footings and foundations of structures assigned to Seismic Design Category C, D, E, or F.

  For structures assigned to Seismic Design Category D, E, or F, provisions of ACI 318, Section 21.8.1 to 21.8.3 shall apply…

Summary

- **OSHPD has determined that both codes provide roughly equivalent fire/life safety protection, though at a lower level than that provided by the CBC**
- **There are significant safety and usability issues with the structural chapters of NFPA 5000**
- **If adopted, usability issues of NFPA 5000 will result in longer design times, and delays in review – all of which translate into costs to the state and the public**

Summary

- **NFPA 5000 does not establish a minimum standard for wood construction, which represents the majority of construction in California**
- **Neither fire and life safety, or structural provisions can be considered separately**
- **If you cannot build a safe structure, the fire and life safety provisions are of no significance**

Conclusion

- **OSHPD proposes adoption of the International Building Code and International Fire Code as the model codes to serve as the basis for the California Building Code and California Fire Code**

Chapter 16A

Structural Design

Comparison Summary

The structural design chapters, Chapter 16 in the *IBC* and Chapter 35 of *NFPA 5000*, form basis for all structural design. This chapter sets forth loading and design criteria for the vertical and lateral force resisting systems. The format and presentation of the structural design chapters in the two model codes vary significantly. Both model codes rely on *ASCE 7-02* for much of the coverage of loads and forces on structures.

IBC 2003

Chapter 16 of the *IBC* is 93 pages long, and is divided into 23 sections. The chapter has been organized somewhat differently compared to the *CBC*, chiefly as a result of the adoption of portions of *ASCE 7-02* by reference. However, the format and order of presentation of the material will be familiar to individuals who use the *CBC*.

IBC sections governing dead and live loads, and combinations of loads will be familiar to *CBC* users, although some changes have been made. Significantly more extensive coverage of wind, snow and flood loads are provided, both in the *IBC* and through references to the corresponding sections of *ASCE 7-02*. California amendments covering partitions, location of vertical elements, distribution of horizontal shear, and stability against overturning were not incorporated into the *IBC*.

IBC contains both a simplified approach for wind design, as well as references to *ASCE 7-02* Section 6. This is a positive feature, since the wind design provisions of *ASCE 7-02* are significantly more complex than those found in the *CBC*. The precise relationship between the wind provisions in *IBC* Division III-Wind Design, and the simplified method in *ASCE 7-02* Section 6.4 is not clear, although the provisions appear compatible, and the *ASCE 7-02* Section 6.4 method is listed as an alternative method. The determination of importance factors for wind when using *ASCE 7-02* is somewhat unclear. Importance factors that are defined *ASCE 7-02* Table 6-1 differ from those in Table 1604.5 of *IBC*.

Seismic design can be performed using a number of different approaches. Designs in accordance with *ASCE 7-02*, Sections 9.1 through 9.6, 9.13 and 9.14 are permitted. Sections 9.7 through 9.12, which deal with foundations and structural materials, are not referenced. The appropriate chapters in the *IBC* are enforced instead. In this manner, a direct conflict with the *ASCE 7-02*, which references the 1999 edition material standards, is avoided. The *IBC* material chapters amend the 2002 edition material standards to provide compatibility with *ASCE 7-02*.

The *IBC* provides a simplified analysis approach for certain classes of structures in Seismic Use Group I. All other structures must use one of the analysis methods listed

in *ASCE 7-02* Section 9.2.5.1. Design of nonstructural components, nonbuilding structures, and base isolated structures, are governed by *ASCE 7-02*.

A number of detailed requirements for seismic design are included in Chapter 16, which supplement those found in *ASCE 7-02*. In general, it appears these provisions enhance the overall level of safety provided by the code.

NFPA 5000

In *NFPA 5000*, structural design is covered in the 8 ½ pages of Chapter 35. As with other structural chapters in *NFPA 5000*, heavy reliance is placed on referenced publications. A sizable portion of Chapter 35 simply transcribes portions of *ASCE 7-02*. Organization of the chapter is very different from that found in the *CBC*. References in Chapter 35 are especially troublesome, tending to be overbroad. For example, *NFPA 5000* Section 35.1.2.8.1.2 requires that drift limits applicable to earthquake loading shall be in accordance with Section 9 of *ASCE 7-02*. Given that Section 9 of *ASCE 7-02* is over 100 pages long, searching the chapter for references to drift is a sizable task. In contrast, the drift requirements of the *IBC* specify a specific section in *ASCE 7-02*.

Although organized differently, *NFPA 5000* sections governing dead and live loads, and combinations of loads will be familiar to CBC users. The wind, snow, and flood loads are all covered in detail in *ASCE 7-02*. Many California amendments, including those covering partitions, location of vertical elements, distribution of horizontal shear, and stability against overturning are not covered in the *NFPA 5000*. One drawback of the *NFPA 5000* code is the lack of simplified provisions for typical structures. For example, all structures, regardless of size or occupancy, must be designed using the complex wind provisions of *ASCE 7-02*.

Specific seismic provisions in *NFPA 5000* are virtually nonexistent, except for the general reference to *ASCE 7-02*.

Summary

IBC Chapter 16 covers structural design in considerably greater depth than *NFPA 5000* Chapter 35. By providing specific materials chapters within the code, rather than relying on the materials provisions of *ASCE 7-02*, *IBC* avoids the direct conflicts and potential safety issues inherent in adopting material standards different from those specified in *ASCE 7-02*.

.

NFPA 5000 effectively amends *ASCE7-02* in a most profound way, by adopting and forcing the use of editions of material standards in *NFPA 5000* Chapters 41, 43, and 44, that differ from those specified in ASCE7-02. Without necessary amendments to correct deficiencies in these material standards, *NFPA 5000* creates significant coordination and safety issues. It must be noted that since the materials chapters in *NFPA 5000* specifically reference the 2002 editions of the material standards, Section 1.3.2 of *NFPA 5000* mandates their use – building in a host of conflicts and deficiencies.

At this time, the 2002 editions of the material standards are still under consideration for adoption into the 2003 NEHRP *Provisions* and *ASCE 7-05*. These documents are still being prepared at the national level. *IBC* adopts the 2002 editions of the materials

standards, but amends and coordinates them with other structural code provisions. By adopting the 2002 editions in advance of their consideration by the national standards, without coordinating and amending them, *NFPA 5000* has short-circuited the acceptance process.

Chapter 16A - Structural Design Requirements

2001 CBC	2003 IBC	Comments
Division I.GENERAL DESIGN REQUIREMENTS		
SECTION 1601A . SCOPE Section 1601A contains the scoping language for the chapter on Structural Design Requirements, indicating agencies responsible for different classifications of structures. It also contains references for existing buildings.	**1601Scope**. Single sentences stating that chapter 16 govern the structural design of buildings, structures, and portions thereof. ASCE 7, Section 9.1 General Provisions, contains general provisions as they pertain to seismic design.	Significant amendments required ASCE 7 contains requirements on alterations, additions, and change of use in Section 9.1 that are currently contained in non-structural chapters.
SECTION 1602A . DEFINITIONS Terms are defined for use in the code:	**1602 Definitions.** .	Significant additions to list
SECTION 1603A . NOTATIONS Some of the variables used in design are defined. However, variables are defined throughout the Sections of Chapter 16..	**1602 Definitions.** Notation included in Definitions section	
	Section 1603. Construction Documents	Requirements for construction documents. Corresponds to requirements in the Administrative Code. Amendments required.
SECTION 1604A . STANDARDS In this section, CBC recognizes three standards for wind design: ASCE 7, (for design loads for buildings and other structures) ANSI EIA/TIA 222-E, for steel antenna towers and antenna supporting structures ANSI/NAAMM FP1001, for flagpoles	**Chapter 35 Referenced Standards** Section includes all referenced standards in the code, including the code sections wherein the standard is referenced	Coordination required. IBC 2003 and ASCE 7 reference different editions of the same standards. However, IBC does not appear to adopt Section A.9 of ASCE 7, wherein the material standards are referenced.
SECTION 1605A . DESIGN **1605A.1 General**. General requirement that buildings and other structures and all portions thereof shall be designed and constructed to sustain the loads specified in the code. Specifies permissible design approaches (ASD and Strength). Permits "deemed to comply" conventional construction of light-frame structures.	**Section 1604 GENERAL DESIGN REQUIREMENTS** **1604.1 General** **1604.2 Strength**	Amendments required. Section does not cover alternative methods or construction procedures.
1605A.2 Rationality. Requirement for rational analysis.	**1604.4 Analysis**	Similar language
1605A.2.1 Distribution of horizontal shear. Distribution of lateral force to vertical elements. Consideration of Torsion.	No corresponding requirements in IBC 2003. ASCE 7 Section 9.5.5.5.2 covers torsion for seismic	Significant amendment required to cover distribution of lateral loads
1605A.2.2 Stability against overturning. General requirements. References Section 1611A.6 for retaining walls, Section 1615A for wind and Section 1626A for seismic.	No corresponding requirements in IBC 2003. Overturning for seismic is in ASCE 7 Section 9.5	Significant amendment required covering wind and soil retaining structures.
1605A.2.3 Anchorage. Anchorage of the roof to walls and columns, and of walls and columns to foundations. References sections 1632A, 1633A.2.8 and 1633A.2.9.	**1604.8**. Seismic requirements for anchorage of walls to roof also covered in ASCE 7. Requirements vary with SDC.	Significant amendment required.
1605A.3 Erection of Structural Framing. Walls and structural framing shall be erected true and plumb in accordance with the design.	No corresponding requirements in IBC 2003.	Amendment required.
1605A.4 Alternate Method. Acceptance and approval by the enforcement agency of design, materials or types of	Covered in part in Section 104.11. 1604.6 In-situ load test 1604.7 Preconstruction load tests	Amendment required.

2001 CBC	2003 IBC	Comments
construction other than those recognized in the regulations.		
1605A.5 Construction Procedures. Unusual erection or construction procedures.	No corresponding requirements in IBC 2003.	Amendment required.
SECTION 1606A . DEAD LOADS **1606A.1 General.** **1606A.2 Partition Loads.** Buildings where partition locations are subject to change use 20 pounds per square foot (psf) of floor area. Exception for access floors.	**1606 Dead Loads**. **1607.5 Permanent Partition Loads**. The actual weight of all permanent partitions shall be included	Amendment required to specify minimum partition load for seismic design.
SECTION 1607A . LIVE LOADS **1607A.1 General.**	**1607 Live Loads.** **1607.1 General**. **1607.2 Loads not Specified** **1607.3 Uniform live loads** **1607.4 Concentrated loads**	IBC references definition.
1607A.2 Critical Distribution of Live Loads.	**1607.1 Distribution of floor loads** **1607.11.1 Distribution of roof loads**	Similar requirements
1607A.3 Floor Live Loads. **1607A.3.1 General.** References Table 16A-A **1607A.3.2 Distribution of uniform floor loads** **1607A.3.3 Concentrated Loads** **1607A.3.4 Special Loads**	**1607.3 Uniform live loads** **1607.4 Concentrated loads** References Table 1607.1- **1607.7 Loads on handrails, guards, grab bars and vehicle barriers**	Arranged differently but similar provisions. Minor CA amendments
1607A.3.5 Live loads posted. *The live loads used in the design of floor and other areas shall be conspicuously posted* ***1607A.3.5.1 [For DSA-SS].*** *The owner or school board shall be responsible for keeping the actual load below the allowable limits.* ***1607A.3.5.2 [For OSHPD 1 & 4].*** *The hospital owner or hospital governing board shall be responsible for keeping the actual load below the allowable limits.*	No provisions in IBC 2003	Amendment required
1607A.4 Roof Live Loads. **1607A.4.1 General.** *The design dead loads shall provide for the weight of at least one reroofing in addition to other applicable loadings if the new roofing can be applied over the original roofing without its removal.*	**1607.11 Roof loads**	Amendment required for reroof
1607A.4.2 Distribution of loads. allows live loads on adjacent spans and on alternate spans. Special requirements for light-gage metal preformed structural sheets **1607A.4.3 Unbalanced loading.** Unbalanced loads shall be used where such loading will result in larger members or connections. Special requirements for trusses and arches	**1607.11.1** Permits use of alternate spans for capacity check. **1608.5** Distribution of snow loads on continuous span members	Amendment required for light-gage metal roofs and unbalanced loading
1607A.4.4 Special roof loads. Roofs to be used for special purposes shall be designed for appropriate loads as approved by the *enforcement agency*. *Uncovered open-frame roof structures shall be designed for a vertical live load of not less than 10 pounds per square foot (0.48 kN/m2) of the total area encompassed by the framework.*	**1607.11.2 Minimum roof live loads** **1607.11.2.1 Flat, pitched and curved roofs** **1607.11.2.2 Special-purpose roofs** **1607.11.2.3 Landscaped Roofs** **1607.11.2.4 Awnings and canopies.**	2003 IBC requirements more comprehensive

Chapter 16A - Structural Design Requirements

2001 CBC	2003 IBC	Comments
1607A.5 Reduction of Live Loads.	**1607.9 Reduction in Live Loads**. Alternate method is the one currently adopted by OSHPD and DSA	Amendment may be required.
SECTION 1608A. SNOW LOADS References Chapter 16A, Division II.		
SECTION 1609A . WIND LOADS References Chapter 16A, Division III.		
SECTION 1610A . EARTHQUAKE LOADS References Chapter 16A, Division IV.		
SECTION 1611A . OTHER MINIMUM LOADS **1611A.1 General.**	**1605.3.1.2 Other Loads.**	Similar language
1611A.2 Other Loads. Buildings and other structures and portions thereof shall be designed to resist all loads due to applicable fluid pressures, *F,* lateral soil pressures, *H,* ponding loads, *P,* and self-straining forces, *T.* See Section 1611A.7 for ponding loads for roofs. **1611A.3 Impact Loads.** Impact loads shall be included in the design of any structure where impact loads occur.	**1607.12 Crane loads** **1607.8 Impact Loads.** **1607.6 Truck and bus garages**	2003 IBC requirements more comprehensive
1611A.4 Anchorage of Concrete and Masonry Walls.	**1604.8 Anchorage** Seismic requirements for anchorage of walls to roof covered in Chapter 9 ASCE 7. Requirements vary with SDC.	Relationship between 1604.8 and ASCE 7 is unclear
1611A.5 Interior Wall Loads. Interior walls, permanent partitions and temporary partitions	**1607.13 Interior Walls and Partitions**.	Amendment required. 2003 IBC does not include partition height or deflection criteria
1611A.6 Retaining Walls.. *Retaining walls higher than 12 feet shall be designed to resist the additional earth pressure caused by seismic ground shaking.* *The resultant of the vertical loads and lateral pressures acting on the wall and its base shall pass through the middle half of the bottom of the footing.* *Gravity walls require approval*	**Section 1806 Retaining Walls.**	Amendments required. IBC only notes FS=1.5 for sliding and overturning.
1611A.7 Water Accumulation. All roofs shall be designed with sufficient slope or camber to ensure adequate drainage. Ponding load shall include water accumulation from any source, including snow, due to deflection. Section 1506 and Table 16A-C, Footnote 3, for drainage slope. Section 1615A for deflection criteria.	**1604.3 Serviceability** Covers basic deflection criteria **Section 1611 Rain loads**	Amendments required
1611A.8 Hydrostatic Uplift. All foundations, slabs and other footings subjected to water pressure shall be designed to resist a uniformly distributed uplift load, *F,* equal to the full hydrostatic pressure.	No provisions in 2003 IBC	Amendments required
1611A.9 Flood-resistant Construction. For flood-resistant construction requirements, where specifically adopted, see Appendix Chapter 31, Division I.	**Section 1612 Flood Loads.** Extensive requirements	2003 IBC requirements much more comprehensive. However, some of the flood design provisions may be incompatible or in conflict with seismic

2001 CBC	2003 IBC	Comments
		design provisions.
1611A.10 Heliport and Helistop Landing Areas.	**1605.5 Heliports and Helistops**	Similar provisions
1611A.11 Prefabricated Construction. **1611A.11.1 Connections.** **1611A.11.2 Pipes and conduit.** **1611A.11.3 Tests and inspections.** ***1611A.12 Reviewing Stands, Grandstands and Bleachers.***	No requirements. (Blind reference in index).	Amendments required.
1611A.12.1 Portable bleachers. ***1611A.12.2 Portable folding indoor bleachers.*** *Portable folding indoor bleachers shall be designed and detailed to resist over-turning and sway in any direction in both the open and closed position when subjected to a lateral force of 0.30 times the dead load weight applied at the center of gravity.*	**1024.1.1** Footboards referred to ICC 300	Very little data. Amendments required.
1611A.13 Freestanding Cantilever Walls. *A stability check against the possibility of overturning shall be performed for isolated spread footings which support freestanding cantilever walls.*	No requirements	Amendments required
SECTION 1612A . COMBINATIONS OF LOADS **1612A.1 General.**	**Section 1605 Load Combinations.**	Similar general requirements
1612A.2 Load Combinations Using Strength Design or Load and Resistance Factor Design. **1612A.2.1 Basic load combinations.** **1612A.2.2 Other loads** **1612A.3 Load Combinations Using Allowable Stress Design.** **1612A.3.1 Basic load combinations.** **1612A.3.2 Alternate basic load combinations.**	**Section 1605 Load Combinations.** Also references Sections 2.3 and 2.4 of ASCE 7	Minor amendments may be required.
1612A.3.3 Other loads. **1612A.4 Special Seismic Load Combinations.**	**1605.3.2.1Other Loads** **1605.4 Special Seismic Load Combinations**	Similar provisions
SECTION 1613A . DEFLECTION ***1613A.1 General.***	**1604.3 Serviceability** **1604.3.1 Deflections**	Significant differences. Amendments required
1613A.2 Lateral Load Deflection. ***1613A.2.1 General.*** *The deflection of structural systems designed to resist wind or seismic loads shall be such that other portions of the structure are not overstressed.* ***NOTE:*** *See Section 1633A.2.4.*	**1604.3 Serviceability** Drift limits applicable to earthquake loading are referenced elsewhere in Chapter 16 and in ASCE & Section 9.	Amendment may be necessary
1613A.2.2 Vertical framing systems or elements. ***1613A.2.2.1 Deflection normal to plane of wall.*** *Exterior wall elements.* ***1613A.2.2.2 Story drift in plane of wall or vertical frame.*** *The lateral displacement of glazed openings.* ***1613A.2.2.3 Location of vertical lateral-force-resisting elements.*** *Limits on distance between vertical lateral force resisting elements*	No provisions in 2003 IBC	Extensive amendments required
1613A.2.3 Horizontal diaphragms. *The maximum span-width ratio for roof or floor diaphragms.*	No provisions in 2003 IBC	Amendment required
Division II.SNOW LOADS **SECTION 1614A . SNOW LOADS**	**Section 1608 Snow Loads.**	2003 IBC requirements much more comprehensive. Amendment required for

2001 CBC	2003 IBC	Comments
1614A.1 Snow Load Posting. *Snow loads used in design shall be posted as for live loads. See Section 1607A.3.5. Snow accumulation removal shall begin when the depth of snow creates loadings of 75 percent of the design values.*		posting
Division III.WIND DESIGN **SECTION 1615A . GENERAL** Structures sensitive to dynamic effects, such as *structures* with a height-to-width ratio greater than five, structures sensitive to wind-excited oscillations, such as vortex shedding or icing, and buildings over 400 feet (121.9m) in height, shall be, and any structure may be, designed in accordance with approved national standards. The provisions of this section do not apply to building and foundation systems in those areas subject to scour and water pressure by wind and wave action. Buildings and foundations subject to such loads shall be designed in accordance with approved national standards.	**Section 1609 Wind Loads.** References Section 6 of ASCE 7. Alternatives (1) Simplified procedure Section 1609.6 (restricted to smaller buildings) (2) Publication on hurricane restant residential constructin (3) Wood frame construction manual for one and two family dewellings (4) Flag poles (5) Antennas	2003 IBC/ASCE 7 requirements much more comprehensive.
SECTION 1616A . DEFINITIONS	**1609.2 Definitions**	Minor amendments required
SECTION 1617A . SYMBOLS AND NOTATIONS	**None**	
SECTION 1618A . BASIC WIND SPEED	**1609.3 Basic Wind Speed**.	Simplified procedure
SECTION 1619A . EXPOSURE *Exposure C is default requirement unless additional data provided*	**1609.4 Exposure Category.**	Simplified procedure. Amendment required.
SECTION 1620A . DESIGN WIND PRESSURES *Includes provisions story drift due to wind*	**1609.6.2.1 Main windforce-resisting system**. May also use ASCE 7 Section 6.4 (Simplified Procedure) or 6.5 (Analytical; Procedure)	Simplified procedure. Relationship with ASCE 7 Section 6.4 unclear. ASCE 7 requirements much more complex. Amendment required for drift
SECTION 1621A . PRIMARY FRAMES AND SYSTEMS	ASCE 7 Section 6.4 (Simplified Procedure) or 6.5 (Analytical; Procedure)	Simplified procedure. May also use ASCE 7 requirements, which are much more complex. Amendment required for uplift
SECTION 1622A . ELEMENTS AND COMPONENTS OF STRUCTURES	**1609.6.2.2 Components and cladding** ASCE 7 Section 6.4 (Simplified Procedure) or 6.5 (Analytical; Procedure)	Simplified procedure. May also use ASCE 7 requirements, which are much more complex.
SECTION 1623A . OPEN-FRAME TOWERS	ASCE 7 Section 6.5 (Analytical; Procedure)	ASCE 7 requirements much more complex.
SECTION 1624A . MISCELLANEOUS STRUCTURES	ASCE 7 Section 6.4 (Simplified Procedure) or 6.5 (Analytical; Procedure)	ASCE 7 requirements much more complex.
	1609.7 Roof systems	Wind requirements for roof systems. Not covered in 2001 CBC
SECTION 1625A . OCCUPANCY CATEGORIES	1604.5 Importance factors	Relationship with ASCE 7 Section 6.5.5 and Section 9.1.4 unclear.
Division IV.EARTHQUAKE DESIGN **SECTION 1626A . GENERAL** **1626A.2 Minimum Seismic Design.** **1626A.3 Seismic and Wind Design.** ***1626A.4 [For OSHPD 1 & 4] Configuration***	**Section 1614 EARTHQUAKE LOADS - GENERAL** Section 9 of ASCE 7.	Amendments required for minimum seismic design, configuration, additions and alterations. Permits designs in accordance with Section 9.1 through 9.6.9.13 and Section 9.14 of ASCE 7.
SECTION 1627A . DEFINITIONS	**Section 1613 EARTHQUAKE LOADS DEFINITIONS** ASCE 7 Section 9.2	Extensive amendments required to cover additions, repairs and alterations
SECTION 1628A . SYMBOLS AND NOTATIONS	ASCE 7 Section 9.2.2	No separate notation section in 2003 IBC
SECTION 1629A . CRITERIA SELECTION **1629A.1 Basis for Design.**	**Section 1619 EARTHQUAKE LOADS – CRITERIA SELECTION** Section 1616.1 Structural design criteria ASCE 7 Section 9.1	
1629A.2 Occupancy Categories.	1616.2 Seismic use groups and	Fundamental change in approach.

Chapter 16A - Structural Design Requirements

2001 CBC	2003 IBC	Comments
	occupancy importance factors ASCE 7 Section 9.1	Seismic design requirements now based on Seismic Design Category (SDC) that is a function of occupancy and seismic risk. Extensive amendments required. 2003 IBC and ASCE 7 permit widespread use of very low ductility lateral force resisting systems. 2003 IBC permits determination of SDC based only on the short period motion.
1629A.3 Site Geology and Soil Characteristics. **1629A.4 Site Seismic Hazard Characteristics.** **1629A.4.1 Seismic zone.** **1629A.4.2 Seismic Zone 4 near-source factor** **1629A.4.3 Seismic response coefficients.**.	**Section 1615 EARTHQUAKE LOADS-SITE GROUND MOTION** ASCE 7 Section 9.4.1.2.2, 9.4.1.2.3 ASCE 7 Section 9.4.1.2.1 ASCE 7 Section 9.4.1.2.4	Zone maps have been replaced by contour maps. Seismic demand is different. There are no near source factors
1629A.5 Configuration Requirements. **1629A.5.1 General** **1629A.5.2 Regular structures.** **1629A.5.3 Irregular structures.**	1616.5 Building configuration ASCE 7 Section 9.5.2.3	2003 IBC requires use of ASCE 7 to determine configuration, unless simplified design procedure is used. Similar provisions to 2001 CBC. Some amendments required
1629A.6 Structural Systems. **1629A.6.1 General.** **1629A.6.2 Bearing wall system.** **1629A.6.3 Building frame system.** **1629A.6.4 Moment-resisting frame system.** **1629A.6.5 Dual system.** **1629A.6.6 Cantilevered column system.** **1629A.6.7 Undefined structural system**. **1629A.6.8 Nonbuilding structural system.** **1629A.7 Height Limits**	Section 1617.6 Seismic force-resisting systems ASCE 7 Section 9.5.2.1 ASCE 7 Section 9.5.2.2	Extensive amendments required. Series of specific requirements and references to ASCE 7. Permits widespread use of very low ductility lateral force resisting systems.
1629A.8 Selection of Lateral-force Procedure. **1629A.8.1 General.** **1629A.8.2 Simplified static.** *[Not adopted by OSHPD.]* **1629A.8.3 Static.** **1629A.8.4 Dynamic.**	1616.6 Analysis procedures ASCE 7 Section 9.5.2.5 ASCE 7 Section 9.5.2.5.1	Extensive amendments required. Contains specific language as well as references to ASCE 7. Permits index and simplified lateral force design procedures. ASCE 7 permits 6 analytical methods: 1. Index force analysis 2. Simplified analysis 3. Equivalent lateral force analysis 4. Modal response spectrum analysis 5. Linear response history analysis 6. Nonlinear response history analysis
1629A.9 System Limitations **1629A.9.1 Discontinuity**	1617.6.2.4 Seismic limitation or Seismic Design Category D, E, or F ASCE 7 Section 9.5.2.6.2.4	
1629A.9.2 Undefined structural systems	ASCE 7 Section 9.5.2.2	Amendment required
1629A.9.3 Irregular features	ASCE 7 Section 9.5.2.3	Significant amendments required
SECTION 1630A . MINIMUM DESIGN LATERAL FORCES AND RELATED EFFECTS **1630A.1 Earthquake Loads and Modeling Requirements.** **1630A.1.1 Earthquake loads.** Redundancy Factor Seismic dead load	**Section 1617 EARTHQUAKE LOADS – MINIMUM DESIGN LATERAL FORCE AND RELATED EFFECTS** ASCE 7 Section 9.5.2.5 1617.2 Redundancy ASCE 7 Section 9.5.2.7.1 ASCE 7 Section 9.5.2.4 ASCE 7 Section 9.5.3	Amendments required. 2003 IBC and ASCE 7 links design and detailing requirements to SDC rather than importance or occupancy. Many references to portions of ASCE 7 Weight definition must be moved out of the index force provisions. Amendment for unbalanced soil loads required.
1630A.1.2 Modeling requirements.	No direct requirements in 2003 IBC ASCE 7 Section 9.5.3 through 9.5.8	Extensive amendments required. Modeling requirements vary depending on

Chapter 16A - Structural Design Requirements

2001 CBC	2003 IBC	Comments
1630A.1.3 *PΔ*. effects. **1630A.2 Static Force Procedure.** **1630A.2.1 Design base shear.** **1630A.2.2 Structure period.** **1630A.2.3 Simplified design base shear.** *[Not adopted by OSHPD]* **1630A.2.3.1 General.** **1630A.2.3.2 Base shear.** **1630A.2.3.3 Vertical distribution.**. **1630A.2.3.4 Applicability.**	ASCE 7 Section 9.5.5.7 1617.4 Equivalent lateral force procedure for seismic design ASCE 7 Section 9.5.5 ASCE 7 Section 9.5.5.2 ASCE 7 Section 9.5.5.3 ASCE 7 Section 9.5.4 1617.5 Simplified analysis procedure for seismic design of buildings	the analysis procedure chosen. Many references to ASCE 7. Amendments required Not adopted by OSHPD
1630A.3 Determination of Seismic Factors. **1630A.3.1 Determination of Ω*o*.** **1630A.3.2 Determination of *R*.**	1617.6 Seismic force resisting systems ASCE 7 Section 9.5.2.2	Extensive amendments required. 2003 IBC and ASCE 7 permits widespread use of very low ductility lateral force resisting systems.
1630A.4 Combinations of Structural Systems. **1630A.4.1 General.** **1630A.4.2 Vertical combinations.** **1630A.4.3 Combinations along different axes.** **1630A.4.4 Combinations along the same axis.**	1617.6.2 (simplified method only) ASCE 7 Section 9.5.2.2	Amendments required. Interrelationship between ASCE 7 and 2003 IBC is confusing
1630A.5 Vertical Distribution of Force.. **1630A.7 Horizontal Torsional Moments.**	1617.5.2 Vertical distribution ASCE 7 Section 9.5.5.4 1620.4.1 ASCE 7 Section 9.5.5.	Requirements in both ASCE 7 and 2003 IBC. Amendments required
1630A.8 Overturning. **1630A.8.1 General.**	ASCE 7 Section 9.5.5.6	Requirements are in ASCE 7. Amendments required
1630A.8.2 Elements supporting discontinuous systems. **1630A.8.2.1 General** **1630A.8.2.2 Detailing requirements in Seismic Zones 3 and 4**	1620.1 Structural component design and detailing, 1620.2.3 (simplified design) 1620.2.9 (simplified design) ASCE 7 Section 9.5.2.6.2.11 ASCE 7 Section 9.5.2.6.4.2 ASCE 7 Section 9.5.2.6.5.1	Amendments required. Varies with SDC Relationship between 2003 IBC provisions and ASCE 7 unclear.
1630A.8.3 At foundation.	No requirements	Amendment required
1630A.9 Drift.	1617.3 Deflection and drift limits ASCE 7 Section 9.5.2.8 ASCE 7 Section 9.5.5.7	Varies with analysis method. References to ASCE 7.
1630A.9.1 Determination of Δ*S*.	ASCE 7 Section 9.5.5.7.1	
1630A.9.2 Determination of Δ*M*	ASCE 7 Section 9.5.5.7.1 ASCE 7 Section 9.5.6.6	
1630A.10 Story Drift Limitation.	ASCE 7 Section 9.5.2.8 ASCE 7 Section 9.5.4.4 ASCE 7 Section 9.5.6.6 ASCE 7 Section 9.5.8.3	Amendment required. Permissible drifts depend on analysis method
1630A.10.1 General.	ASCE 7 Section 9.5.5.7	
1630A.10.2 Calculated.		
1630A.10.3 Limitations.		
1630A.11 Vertical Component.	1620.4.2 Vertical seismic forces ASCE 7 Section 9.5.2.6.4.3	Amendment required
SECTION 1631A . DYNAMIC ANALYSIS PROCEDURES **1631A.1 General.**	**Section 1618 DYNAMIC ANALYSIS PROCEDURE FOR THE SEISMIC DESIGN OF BUILDNGS** ASCE 7 Section 9.5.6	References ASCE 7. Dynamic procedures cover only the modal analysis. Other requirements (ground motion, detail requirements) not tied to procedure
1631A.2 Ground Motion.	ASCE 7 Section 9.4.1.2.6	May require amendment
1631A.3 Mathematical Model.	**Section 1619 EARTHQUAKE LOADS, SOIL-STRUCTURE INTERACTION** ASCE 7 Section 9.5.9 ASCE 7 Section 9.5.6.2	May require amendment

Chapter 16A - Structural Design Requirements

2001 CBC	2003 IBC	Comments
1631A.4 Description of Analysis Procedures.		
1631A.4.1 Response spectrum analysis.		
1631A.4.2 Time-history analysis.	ASCE 7 9.5.8	Amendment required. ASCE 7 permits nonlinear response history analysis
1631A.5 Response Spectrum Analysis.	ASCE 7 Section 9.5.6	
1631A.5.1 Response spectrum representation and interpretation of results.	ASCE 7 Section 9.5.6. ASCE 7 Section 9.5.6.7	
1631A.5.2 Number of modes.	ASCE 7 Section 9.5.6.3	
1631A.5.3 Combining modes.	ASCE 7 Section 9.5.6.6	
1631A.5.4 Reduction of Elastic Response Parameters for design.	ASCE 7 Section 9.5.6.5	Amendment may be required
1631A.5.5 Directional effects.	ASCE 7 Section 9.5.2.5.2 ASCE 7 Section 9.5.2.6.2.4	Amendment may be required. Requirements vary with SDC
1631A.5.6 Torsion.	ASCE 7 Section 9.5.5.4	Amendment may be required
1631A.5.7 Dual systems.	ASCE 7 Section 9.5.2.2.1	Amendment required
1631A.6 Time-history Analysis. **1632A.1 General.**	ASCE 7 Section 9.5.7	Detailed review needed
1631A.6.1 Time history.	ASCE 7 Section 9.5.7.2	
1631A.6.2 Elastic time-history analysis.	ASCE 7 Section 9.5.7.2 ASCE 7 Section 9.5.7.3	
1631A.6.3 Nonlinear time-history analysis.	ASCE 7 Section 9.5.8	Extensive review needed. Amendments likely to be required
1631A.6.3.1 Nonlinear time history.	ASCE 7 Section 9.5.8	
1631A.6.3.2 Design review. *[Not adopted by OSHPD]*	ASCE 7 Section 9.5.8.4	Amendment required
SECTION 1632A . LATERAL FORCE ON ELEMENTS OF STRUCTURES, NONSTRUCTURAL COMPONENTS AND EQUIPMENT SUPPORTED BY STRUCTURES	**Section 1621 ARCHITECTURAL, MECHANICAL AND ELECTRICAL COMPONENT SEISMIC DESIGN REQUIREMENTS** ASCE 7 Section 9.6	Reference to ASCE 7 with modifications for sprinklers, partitions, and mechanical equipment. Significantly more detail in ASCE 7. Extensive coverage of architectural elements including glazing and curtain walls. Significant amendments required for OSHPD performance objectives, especially for sprinklers
1632A.1 General.	ASCE 7 Section 9.6.1	
1632A.2 Design for Total Lateral Force.	ASCE 7 Section 9.6.1.3	
1632A.3 Specifying Lateral Forces.	ASCE 7 Section 9.6.1	
1632A.4 Relative Motion of Equipment Attachments.	ASCE 7 Section 9.6.1.4	
1632A.5 Alternative Designs.	ASCE 7 Section 9.6.3.15	Some amendments required
1632A.6 HVAC Ductwork, Plumbing/Piping and Conduit Systems.	ASCE 7 Section 9.6.3	Some amendments required
SECTION 1633A . DETAILED SYSTEMS DESIGN REQUIREMENTS **1633A.1 General.**	**Section 1650 EARTHQUAKE LOADS-DESIGN DETAILING REQUIREMENTS AND STRUCTURAL COMPONENT LOAD EFFECTS** ASCE 7 Section 9.5.2.2.4.3 ASCE 7 Section 9.5.2.6	References ASCE 7. Requirements based on SDC. Amendment required
1633A.2 Structural Framing Systems. **1633A.2.1 General.**	ASCE 7 Section 9.5.2.2	Amendments required
1633A.2.2 Detailing for combinations of systems.	ASCE 7 Section 9.5.2.2.2	Amendments required
1633A.2.3 Connections		Amendments required
1633A.2.4 Deformation compatibility.	ASCE 7 Section 9.5.2.2.4.3	
1633A.2.4.1 Adjoining rigid elements.	ASCE 7 Section 9.5.2.2.4.2	
1633A.2.4.2 Exterior elements.	ASCE 7 Section 9.6.2.4	
1633A.2.5 Ties and continuity.	ASCE 7 Section 9.5.2.6.1.1	Amendments required. Varies with SDC
1633A.2.6 Collector elements.	Section 1620.2.6 Collector elements ASCE 7 Section 9.5.2.6.2.6	Amendments required. Varies with SDC

Chapter 16A - Structural Design Requirements

2001 CBC	2003 IBC	Comments
	ASCE 7 Section 9.5.2.6.3.1 ASCE 7 Section 9.5.2.6.4.1	
1633A.2.7 Concrete frames.	ASCE 7 Table 9.5.2.2	Amendments required. Varies with SDC
1633A.2.8 Anchorage of concrete or masonry walls.	1620.3.1 Anchorage of concrete or masonry walls ASCE 7 Section 9.5.2.6.1.2 ASCE 7 Section 9.5.2.6.2.8 ASCE 7 Section 9.5.2.6.3.2	Amendments required. Varies with SDC
1633A.2.8.1 Out-of-plane wall anchorage to flexible diaphragms	1620.4.6 Anchorage of concrete or masonry walls to flexible diaphragms ASCE 7 Section 9.5.2.6.3.2	Amendments required. Varies with SDC
1633A.2.9 Diaphragms.	Section 1620.5 Diaphragms ASCE 7 Section 9.5.2.6.2.7 ASCE 7 Section 9.5.2.6.4.4	Amendments required. Varies with SDC
1633A.2.10 Framing below the base.	ASCE 7 Section 9.5.7	Amendments required
1633A.2.11 Building separations.	1620.4.5 Building Separations ASCE 7 Section 9.5.2.8	Amendments required
1633A.2.12 Foundations and superstructure-to-foundation connections.	ASCE 7 Section 9.5.7	Amendments required. Varies with SDC
1633A.2.13 Requirements for elevators.	ASCE 7 Section 9.6.3.16	Amendments required
SECTION 1634A . NONBUILDING STRUCTURES	**Section 1622 NONBUILDING STRUCTURES SEISMIC DESIGN REQUIREMENTS** ASCE 7 Section 9.14	References ASCE 7. Some modifications. ASCE 7 provisions far more extensive. Detailed review and some amendments required
SECTION 1635A . EARTHQUAKE-RECORDING INSTRUMENTATIONS		Amendments required
Division V. SOIL PROFILE TYPES SECTION 1636A . SITE CATEGORIZATION PROCEDURE	**Section 1615 EARTHQUAKE LOADS – SITE GROUND MOTION** ASCE 7 Section 9.4.1.2	New methodology
1636A.1 Scope.	ASCE 7 Section 9.4.1.2	
1636A.2 Definitions	ASCE 7 Section 9.4.1.2.1	
1636A.2.1 Average shear wave velocity.	ASCE 7 Section 9.4.1.2.2.2	
1636A.2.2 average field standard penetration resistance and average standard penetration resistance for cohesionless soil layers.	ASCE 7 Section 9.4.1.2.3	
1636A.2.3 Average undrained shear strength.	ASCE 7 Section 9.4.1.2.3	
1636A.2.4 Soft clay profile,	ASCE 7 Section 9.4.1.2.2	
1636A.2.5 Soil profiles	ASCE 7 Section 9.4.1.2.2	
1636A.2.6 Rock profiles	ASCE 7 Section 9.4.1.2.2	
SECTION 1637A . SITE DATA FOR STATE-OWNED OR STATE-LEASED ESSENTIAL SERVICES		Amendments required
SECTION 1638A [FOR OSHPD 1 & 4] . ADDITIONS, ALTERATIONS, REPAIRS AND SEISMIC RETROFIT TO EXISTING BUILDINGS OR STRUCTURES	**Chapter 34**	Extensive amendments required. To conform with statutory and regulatory requirements
Division VI-R .EARTHQUAKE EVALUATION AND DESIGN FOR RETROFIT OF [FOR BSC, DSA] EXISTING STATE-OWNED BUILDINGS [FOR OSHPD] EXISTING HOSPITAL BUILDINGS		No corresponding provisions.

Chapter 16A - Structural Design Requirements

Stru2001 CBC	2003 NFPA 5000	Comments
Division I.GENERAL DESIGN REQUIREMENTS		
SECTION 1601A . SCOPE Section 1601A contains the scoping language for the chapter on Structural Design Requirements, indicating agencies responsible for different classifications of structures. It also contains references for existing buildings.	**35.1 General.** **35.1.1 Scope.** Single sentences stating that chapter 35 govern the structural design of buildings, structures, and portions thereof. ASCE 7, Section 9.1 General Provisions, contains general provisions as they pertain to seismic design.	Significant amendments required ASCE 7 contains requirements on alterations, additions, and change of use in Section 9.1 that are currently contained in non-structural chapters.
SECTION 1602A . DEFINITIONS Terms are defined for use in the code:	**35.2 Definitions.** Definitions are extracted from ASCE 7. There are no definitions unique to NFPA 5000.	In CBC Chapter 16, the definitions are defined in the portions of the code (Wind, Seismic, etc.) where they are used. In NFPA 5000, some (but not all) of the definitions in ASCE 7 are reproduced in Section 35.2.
SECTION 1603A . NOTATIONS Some of the variables used in design are defined. However, variables are defined throughout the Sections of Chapter 16..	Some notation defined in different Sections of Chapter 35. ASCE 7 Section 9.2.2 summarizes all notation used in ASCE 7. Notation is also defined (redefined) in sections of the various chapters of ASCE 7.	Significant coordination required. NFPA 5000, ASCE 7 Section 9.2.2, and the Chapters of ASCE 7 all define notation. In many cases, the same variable has multiple definitions.
SECTION 1604A . STANDARDS In this section, CBC recognizes three standards for wind design: ASCE 7, (for design loads for buildings and other structures) ANSI EIA/TIA 222-E, for steel antenna towers and antenna supporting structures ANSI/NAAMM FP1001, for flagpoles	NFPA 5000 references an extensive list of standards. ASCE 7 also references an extensive list of standards	Major coordination required. NFPA 5000 and ASCE 7 reference different editions of the same standards. It will be necessary to extensively review and amend the documents to make them compatible
SECTION 1605A . DESIGN **1605A.1 General**. General requirement that buildings and other structures and all portions thereof shall be designed and constructed to sustain the loads specified in the code. Specifies permissible design approaches (ASD and Strength). Permits "deemed to comply" conventional construction of light-frame structures.	**35.1.2* Structural Design**. General design requirements/ **35.1.2.1 Design Methods**. ASD or strength **35.1.2.2 Basic Requirements**. Must meet Section 1.3 of ASCE 7,	Major amendments required. There are no conventional construction provisions for light frame structures in NFPA 5000 or ASCE 7. NFPA 5000 Section 35.1.2.3 lists reference documents for one and two family dwellings. The application of these references is unclear, since some only cover portions of the structure.
1605A.2 Rationality. Requirement for rational analysis.	**35.1.2.4 General Structural Integrity**. Reference to Section 1.4 of ASCE 7. **35.1.2.5 Load Path.** Load path required.	Similar language
1605A.2.1 Distribution of horizontal shear. Distribution of lateral force to vertical elements. Consideration of Torsion.	ASCE 7 Section 9.5.5.5.2 covers torsion for seismic	Significant amendment required to cover distribution of lateral loads
1605A.2.2 Stability against overturning. General requirements. References Section 1611A.6 for retaining walls, Section 1615A for wind and Section 1626A for seismic.	No corresponding requirements in NFPA 5000. Overturning for seismic is in ASCE 7 Section 9.5	Significant amendment required covering wind and soil retaining structures.
1605A.2.3 Anchorage. Anchorage of the roof to walls and columns, and of walls and columns to foundations. References sections 1632A, 1633A.2.8 and 1633A.2.9.	No corresponding requirements in NFPA 5000. Seismic requirements for anchorage of walls to roof covered in ASCE 7. Requirements vary with SDC.	Significant amendment required.
1605A.3 Erection of Structural Framing. Walls and structural framing shall be erected true and plumb in accordance with the design.	No corresponding requirements in NFPA 5000.	Amendment required.

Chapter 16A - Structural Design Requirements

Stru2001 CBC	2003 NFPA 5000	Comments
1605A.4 Alternate Method. Acceptance and approval by the enforcement agency of design, materials or types of construction other than those recognized in the regulations.	Covered in part in NFPA Section 1.5.	Amendment required.
1605A.5 Construction Procedures. Unusual erection or construction procedures.	No corresponding requirements in NFPA 5000.	Amendment required.
SECTION 1606A . DEAD LOADS **1606A.1 General.** **1606A.2 Partition Loads.** Buildings where partition locations are subject to change use 20 pounds per square foot (psf) of floor area. Exception for access floors.	**35.5 Dead Loads**. **35.5.3 Permanent Partition Loads**. The actual weight of all permanent partitions shall be included **35.6.2.3.1.1** In buildings where partitions will be erected or rearranged, provision for partition weight shall be made – no minimum load **35.6.2.3.1.2** Not required where the specified live load exceeds 80 psf (3.83 kN/m2).	Amendment required to specify minimum partition load..
SECTION 1607A . LIVE LOADS **1607A.1 General.**	**35.6 Live Loads.** **35.6.1 General**.	Nearly identical
1607A.2 Critical Distribution of Live Loads.	**35.6.1.4**	Similar requirements
1607A.3 Floor Live Loads. **1607A.3.1 General.** References Table 16A-A **1607A.3.2 Distribution of uniform floor loads** **1607A.3.3 Concentrated Loads** **1607A.3.4 Special Loads**	**35.6.1.2 - 35.6.4** This section references ASCE 7 Table 4-	Arranged differently but similar provisions. Minor CA amendments
1607A.3.5 Live loads posted. *The live loads used in the design of floor and other areas shall be conspicuously posted* ***1607A.3.5.1 [For DSA-SS].*** *The owner or school board shall be responsible for keeping the actual load below the allowable limits.* ***1607A.3.5.2 [For OSHPD 1 & 4].*** *The hospital owner or hospital governing board shall be responsible for keeping the actual load below the allowable limits.*	No provisions in NFPA 5000	Amendment required
1607A.4 Roof Live Loads. **1607A.4.1 General.** *The design dead loads shall provide for the weight of at least one reroofing in addition to other applicable loadings if the new roofing can be applied over the original roofing without its removal.*	No provisions in NFPA 5000	Amendment required
1607A.4.2 Distribution of loads. allows live loads on adjacent spans and on alternate spans. Special requirements for light-gage metal preformed structural sheets **1607A.4.3 Unbalanced loading.** Unbalanced loads shall be used where such loading will result in larger members or connections. Special requirements for trusses and arches	**35.7.1.2.1** Permits use of alternate spans for capacity check. **35.7.1.2.2** Distribution of snow loads on continuous span members shall be in accordance with 35.8.5.	Amendment required for light-gage metal roofs and unbalanced loading
1607A.4.4 Special roof loads. Roofs to be used for special purposes shall be	**35.7.4 Special-Purpose Roofs.** Where occupied for incidental promenade	NFPA 5000 requirements more comprehensive

Chapter 16A - Structural Design Requirements

Stru2001 CBC	2003 NFPA 5000	Comments
designed for appropriate loads as approved by the *enforcement agency*. *Uncovered open-frame roof structures shall be designed for a vertical live load of not less than 10 pounds per square foot (0.48 kN/m2) of the total area encompassed by the framework.*	purposes, roofs shall be designed for a minimum live load of 60 psf (2.87 kN/m2) and 100 psf (4.79 kN/m2) where designed for roof gardens or assembly or educational occupancies. **35.7.4.1** Landscaped roofs. **35.7.4.2** Where awnings and canopies **35.7.4.3** Roofs to be utilized for other special purposes. 35.7.3 Rain Loads. 35.7.3.1 Ponding instability Section 8.4 of ASCE 7. 35.7.3.2 Controlled drainage Section 8.5 of ASCE 7. 35.7.3.3 Rain loading shall also comply with Section 38.11.	
1607A.5 Reduction of Live Loads.	**35.6.7 Reduction in Live Loads**. References Section 4.8 of ASCE 7.	Amendment may be required. Uses a reduction method currently not adopted by DSA/OSHPD
SECTION 1608A. SNOW LOADS References Chapter 16A, Division II.		
SECTION 1609A . WIND LOADS References Chapter 16A, Division III.		
SECTION 1610A . EARTHQUAKE LOADS References Chapter 16A, Division IV.		
SECTION 1611A . OTHER MINIMUM LOADS **1611A.1 General.**	**35.14 Other Minimum Loads.** **35.14.1 General.**	Similar language
1611A.2 Other Loads. Buildings and other structures and portions thereof shall be designed to resist all loads due to applicable fluid pressures, *F,* lateral soil pressures, *H,* ponding loads, *P,* and self-straining forces, *T.* See Section 1611A.7 for ponding loads for roofs. **1611A.3 Impact Loads.** Impact loads shall be included in the design of any structure where impact loads occur.	**35.4.2.6 Other Loads.** **35.4.2.6.1** Special Loads.. **35.6.6*** Impact Loads. Section 4.7 of ASCE 7. **35.6.8** Crane Loads. Section 4.10 in ASCE 7. **35.13 Ice Loads** —Section 10 of ASCE 7**.**	NFPA 5000 requirements more comprehensive
1611A.4 Anchorage of Concrete and Masonry Walls.	Seismic requirements for anchorage of walls to roof covered in Chapter 9 ASCE 7. Requirements vary with SDC.	
1611A.5 Interior Wall Loads. Interior walls, permanent partitions and temporary partitions	**35.6.9 Interior Walls and Partitions**.	Amendment required. NFPA 5000 does not include partition height or deflection criteria
1611A.6 Retaining Walls.. *Retaining walls higher than 12 feet shall be designed to resist the additional earth pressure caused by seismic ground shaking.* Retaining walls shall be designed with a factor of safety of 1.5 for sliding and overturning *The resultant of the vertical loads and lateral pressures acting on the wall and its base shall pass through the middle half of the bottom of the footing.* *Gravity walls require approval*	**35.11 Lateral Soil Loads.** In absence of a geotechnical soil analysis, soil loads in Table 35.11 shall be used as the minimum design lateral soil loads. **Table 35.11 Soil Lateral Load** Additional prescriptive soil loading in this table. Values are less conservative than ASCE 7, Table 5-1.	Extensive amendments required
1611A.7 Water Accumulation. All roofs shall be designed with sufficient slope or camber to ensure adequate drainage. Ponding load shall include water	**35.1.2.8.8* Roof Deflection.** All roofs shall be designed with a slope or camber to allow drainage after the dead load deflection.	Similar provisions

Chapter 16A - Structural Design Requirements

Stru2001 CBC	2003 NFPA 5000	Comments
accumulation from any source, including snow, due to deflection. Section 1506 and Table 16A-C, Footnote 3, for drainage slope. Section 1615A for deflection criteria.		
1611A.8 Hydrostatic Uplift. All foundations, slabs and other footings subjected to water pressure shall be designed to resist a uniformly distributed uplift load, *F,* equal to the full hydrostatic pressure.	**35.14.2 Hydrostatic Uplift.** Loads shall be determined in accordance with Section 5.2 of ASCE 7.	Similar provisions
1611A.9 Flood-resistant Construction. For flood-resistant construction requirements, where specifically adopted, see Appendix Chapter 31, Division I.	**35.4.2.6.2 Flood Loads.** Extensive requirements. Entire Chapter 39 covers flood loads.	NFPA 5000 requirements much more comprehensive. However, some of the flood design provisions may be incompatible or in conflict with seismic design provisions.
1611A.10 Heliport and Helistop Landing Areas.	**35.14.3 Heliport and Helistop Landing Areas.**	Similar provisions
1611A.11 Prefabricated Construction. **1611A.11.1 Connections.** **1611A.11.2 Pipes and conduit.** **1611A.11.3 Tests and inspections.** ***1611A.12 Reviewing Stands, Grandstands and Bleachers.***	No requirements. (Blind reference in index).	Amendments required.
1611A.12.1 Portable bleachers. ***1611A.12.2 Portable folding indoor bleachers.*** *Portable folding indoor bleachers shall be designed and detailed to resist over-turning and sway in any direction in both the open and closed position when subjected to a lateral force of 0.30 times the dead load weight applied at the center of gravity.*	**35.6.2.3.2** Footboards in reviewing stands, grandstands, and bleachers shall be designed to resist 120 lb/linear ft (180 kg/linear m). **35.6.2.3.3** Reviewing stands, grandstands, bleachers, and supporting structures shall meet the requirements of 35.6.2.3.3.1 and 35.6.2.3.3.2.	Different loading. Amendments may be required.
1611A.13 Freestanding Cantilever Walls. *A stability check against the possibility of overturning shall be performed for isolated spread footings which support freestanding cantilever walls.*	No requirements	Amendments required
SECTION 1612A . COMBINATIONS OF LOADS **1612A.1 General.**	**35.15 Load Combinations.**	Similar general requirements
1612A.2 Load Combinations Using Strength Design or Load and Resistance Factor Design. **1612A.2.1 Basic load combinations.** **1612A.2.2 Other loads** **1612A.3 Load Combinations Using Allowable Stress Design.** **1612A.3.1 Basic load combinations.** **1612A.3.2 Alternate basic load combinations.**	**35.15** References Sections 2.3 and 2.4 of ASCE 7	Minor amendments may be required.
1612A.3.3 Other loads. **1612A.4 Special Seismic Load Combinations.**	**35.15 Other Loads** **ASCE 7, Section 9.5.2.7.1**	Similar provisions
SECTION 1613A . DEFLECTION ***1613A.1 General***.	**35.1.2.8 Deflections.** **35.1.2.8.1 General.**	Significant differences. Amendments required
1613A.2 Lateral Load Deflection. ***1613A.2.1 General.*** *The deflection of*	**35.1.2.8.1.2** Drift limits applicable to earthquake loading shall be in accordance	Amendment may not be necessary

Chapter 16A - Structural Design Requirements

Stru2001 CBC	2003 NFPA 5000	Comments
structural systems designed to resist wind or seismic loads shall be such that other portions of the structure are not overstressed. ***NOTE:*** *See Section 1633A.2.4.*	with Section 9 of ASCE 7.	
1613A.2.2 Vertical framing systems or elements. ***1613A.2.2.1 Deflection normal to plane of wall.*** *Exterior wall elements.* ***1613A.2.2.2 Story drift in plane of wall or vertical frame.*** *The lateral displacement of glazed openings.* ***1613A.2.2.3 Location of vertical lateral-force-resisting elements****.* *Limits on distance between vertical lateral force resisting elements*	No provisions in NFPA 5000 **35.1.2.8.6 Glazing**. Glazing supports shall comply with Section 46.9. No provisions in NFPA 5000	Extensive amendments required
1613A.2.3 Horizontal diaphragms. *The maximum span-width ratio for roof or floor diaphragms.*	No provisions in NFPA 5000	Amendment required
Division II.SNOW LOADS **SECTION 1614A . SNOW LOADS** ***1614A.1 Snow Load Posting.*** *Snow loads used in design shall be posted as for live loads. See Section 1607A.3.5. Snow accumulation removal shall begin when the depth of snow creates loadings of 75 percent of the design values.*	**35.8 Snow Loads.** **35.8.1 General.** **ASCE 7. Chapter 7**	NFPA 5000 requirements much more comprehensive. Amendment required for posting
Division III.WIND DESIGN **SECTION 1615A . GENERAL** Structures sensitive to dynamic effects, such as *structures* with a height-to-width ratio greater than five, structures sensitive to wind-excited oscillations, such as vortex shedding or icing, and buildings over 400 feet (121.9m) in height, shall be, and any structure may be, designed in accordance with approved national standards. The provisions of this section do not apply to building and foundation systems in those areas subject to scour and water pressure by wind and wave action. Buildings and foundations subject to such loads shall be designed in accordance with approved national standards.	**35.9 Wind Loads.** References Section 6 of ASCE 7. Alternatives (1) ANSI/NAAMM FP 1001, Guide Specifications for Design of Metal Flagpoles Manual (2) Wind tunnel tests conducted in accordance with Section 6.6 of ASCE 7 (3) ANSI/TIA/EIA-222-F, Structural Standards for Steel Antenna Towers and Antenna Structures (4) Bleachers and grandstands per 35.9.1.6 **35.9.1.5** No part (component, cladding, or fastener) of a building or structure shall be designed for a wind load of less than 10 psf (0.48 kN/m2). **35.9.1.6** Grandstands and bleachers **35.9.1.6.1** Uplift wind pressures **35.9.1.6.2** vertically on closed-deck grandstand	
SECTION 1616A . DEFINITIONS	**ASCE 7 Section 6.2**	Minor amendments required
SECTION 1617A . SYMBOLS AND NOTATIONS	**ASCE 7 Section 6.3**	NFPA 5000/ASCE 7 requirements much more comprehensive.
SECTION 1618A . BASIC WIND SPEED	**35.9.2 Basic Wind Speed**. The basic wind speed determined in accordance with Section 6.5.4 of ASCE 7.	
SECTION 1619A . EXPOSURE *Exposure C is default requirement unless additional data provided*	**35.9.3* Exposure Category. E**xposure category determined using Section 6.5.6 of ASCE 7. **35.9.4** Occupancy Category and Wind Importance Factor. **35.9.4.1** Buildings and other structures shall be assigned an occupancy category in accordance with Table 35.3 to determine the wind load importance factor. 35.9.4.2* Buildings and other structures shall be assigned a wind load importance	Amendment required NFPA 5000/ASCE 7 requirements much more comprehensive.

Chapter 16A - Structural Design Requirements

Stru2001 CBC	2003 NFPA 5000	Comments
	factor (I) in accordance with Section 6.5.5 of ASCE 7.	
SECTION 1620A . DESIGN WIND PRESSURES *Includes provisions story drift due to wind*	ASCE 7 Section 6.4 (Simplified Procedure) or 6.5 (Analytical; Procedure)	Amendment required for drift NFPA 5000/ASCE 7 requirements much more complex.
SECTION 1621A . PRIMARY FRAMES AND SYSTEMS	ASCE 7 Section 6.4 (Simplified Procedure) or 6.5 (Analytical; Procedure)	Amendment required for uplift NFPA 5000/ASCE 7 requirements much more complex.
SECTION 1622A . ELEMENTS AND COMPONENTS OF STRUCTURES	ASCE 7 Section 6.4 (Simplified Procedure) or 6.5 (Analytical; Procedure)	NFPA 5000/ASCE 7 requirements much more complex.
SECTION 1623A . OPEN-FRAME TOWERS	ASCE 7 Section 6.5 (Analytical; Procedure)	NFPA 5000/ASCE 7 requirements much more complex.
SECTION 1624A . MISCELLANEOUS STRUCTURES	ASCE 7 Section 6.4 (Simplified Procedure) or 6.5 (Analytical; Procedure)	NFPA 5000/ASCE 7 requirements much more complex.
SECTION 1625A . OCCUPANCY CATEGORIES	ASCE 7 Section 6.5.5	
Division IV.EARTHQUAKE DESIGN **SECTION 1626A . GENERAL** **1626A.2 Minimum Seismic Design.** **1626A.3 Seismic andWind Design.** ***1626A.4 [For OSHPD 1 & 4] Configuration***	35.10 Earthquake Loads. Section 9 of ASCE 7.	Amendments required for minimum seismic design, configuration, additions and alterations.
SECTION 1627A . DEFINITIONS	ASCE 7 Section 9.2 NFPA 5000 reproduces some of the definitions found in ASCE 7.	Extensive amendments required to cover additions, repairs and alterations
SECTION 1628A . SYMBOLS AND NOTATIONS	ASCE 7 Section 9.2.2 NFPA 5000 reproduces two notations found in ASCE 7.	
SECTION 1629A . CRITERIA SELECTION **1629A.1 Basis for Design.**	ASCE 7 Section 9.1	Amendments required to remove conflicting language on additions, alterations, and retrofits
1629A.2 Occupancy Categories.	ASCE 7 Section 9.1	Fundamental change in approach. Seismic design requirements now based on Seismic Design Category (SDC) that is a function of occupancy and seismic risk. Amendments required.
1629A.3 Site Geology and Soil Characteristics. **1629A.4 Site Seismic Hazard Characteristics.** **1629A.4.1 Seismic zone.** **1629A.4.2 Seismic Zone 4 near-source factor** **1629A.4.3 Seismic response coefficients.**.	ASCE 7 Section 9.4.1.2.2, 9.4.1.2.3 ASCE 7 Section 9.4.1.2.1 ASCE 7 Section 9.4.1.2.4	Zone maps have been replaced by contour maps. Seismic demand is different. There are no near source factors
1629A.5 Configuration Requirements. **1629A.5.1 General** **1629A.5.2 Regular structures.** **1629A.5.3 Irregular structures.**	ASCE 7 Section 9.5.2.3	Similar provisions to 2001 CBC. Some amendments required
1629A.6 Structural Systems. **1629A.6.1 General.** **1629A.6.2 Bearing wall system.** **1629A.6.3 Building frame system.** **1629A.6.4 Moment-resisting frame system.** **1629A.6.5 Dual system.** **1629A.6.6 Cantilevered column system.** **1629A.6.7 Undefined structural system**. **1629A.6.8 Nonbuilding structural system.** **1629A.7 Height Limits**	ASCE 7 Section 9.5.2.1 ASCE 7 Section 9.5.2.2	Extensive amendments required. ASCE 7 permits widespread use of very low ductility lateral force resisting systems.
1629A.8 Selection of Lateral-force Procedure. **1629A.8.1 General.** **1629A.8.2 Simplified static.** *[Not adopted by OSHPD.]*	ASCE 7 Section 9.5.2.5 ASCE 7 Section 9.5.2.5.1	Extensive amendments required. ASCE 7 permits index and simplified lateral force design procedures. ASCE 7 permits 6 analytical methods: 1. Index force analysis

Chapter 16A - Structural Design Requirements

Stru2001 CBC	2003 NFPA 5000	Comments
1629A.8.3 Static. **1629A.8.4 Dynamic.**		2. Simplified analysis 3. Equivalent lateral force analysis 4. Modal response spectrum analysis 5. Linear response history analysis 6. Nonlinear response history analysis
1629A.9 System Limitations **1629A.9.1 Discontinuity**	ASCE 7 Section 9.5.2.6.2.4	
1629A.9.2 Undefined structural systems	ASCE 7 Section 9.5.2.2	Amendment required
1629A.9.3 Irregular features	ASCE 7 Section 9.5.2.3	Significant amendments required
SECTION 1630A . MINIMUM DESIGN LATERAL FORCES AND RELATED EFFECTS **1630A.1 Earthquake Loads and Modeling Requirements.** **1630A.1.1 Earthquake loads.** Redundancy Factor Seismic dead load	ASCE 7 Section 9.5.2.5 ASCE 7 Section 9.5.2.7.1 ASCE 7 Section 9.5.2.4 ASCE 7 Section 9.5.3	Amendments required. ASCE 7 links design and detailing requirements to SDC rather than importance or occupancy Weight definition must be moved out of the index force provisions. Amendment for unbalanced soil loads required.
1630A.1.2 Modeling requirements. **1630A.1.3 *PΔ*. effects.** **1630A.2 Static Force Procedure.** **1630A.2.1 Design base shear.** **1630A.2.2 Structure period.** **1630A.2.3 Simplified design base shear.** *[Not adopted by OSHPD]* **1630A.2.3.1 General.** **1630A.2.3.2 Base shear.** **1630A.2.3.3 Vertical distribution.**. **1630A.2.3.4 Applicability.**	ASCE 7 Section 9.5.3 through 9.5.8 ASCE 7 Section 9.5.5.7 ASCE 7 Section 9.5.5 ASCE 7 Section 9.5.5.2 ASCE 7 Section 9.5.5.3 ASCE 7 Section 9.5.4	Extensive amendments required. Modeling requirements vary depending on the analysis procedure chosen. Amendments may be required Amendments required Not adopted by OSHPD
1630A.3 Determination of Seismic Factors. **1630A.3.1 Determination of Ω*o*.** **1630A.3.2 Determination of *R*.**	ASCE 7 Section 9.5.2.2	Extensive amendments required. ASCE 7 permits widespread use of very low ductility lateral force resisting systems.
1630A.4 Combinations of Structural Systems. **1630A.4.1 General.** **1630A.4.2 Vertical combinations.** **1630A.4.3 Combinations along different axes.** **1630A.4.4 Combinations along the same axis.**	ASCE 7 Section 9.5.2.2	Amendments required
1630A.5 Vertical Distribution of Force.. **1630A.7 Horizontal Torsional Moments.**	ASCE 7 Section 9.5.5.4 ASCE 7 Section 9.5.5.	Requirements similar
1630A.8 Overturning. **1630A.8.1 General.**	ASCE 7 Section 9.5.5.6	Amendments required
1630A.8.2 Elements supporting discontinuous systems. **1630A.8.2.1 General** **1630A.8.2.2 Detailing requirements in Seismic Zones 3 and 4**	 ASCE 7 Section 9.5.2.6.2.11 ASCE 7 Section 9.5.2.6.4.2 ASCE 7 Section 9.5.2.6.5.1	Amendments required. Varies with SDC
1630A.8.3 At foundation.	No requirements	Amendment required
1630A.9 Drift.	ASCE 7 Section 9.5.2.8 ASCE 7 Section 9.5.5.7	Varies with analysis method
1630A.9.1 Determination of Δ*S*.	ASCE 7 Section 9.5.5.7.1	
1630A.9.2 Determination of Δ*M*	ASCE 7 Section 9.5.5.7.1 ASCE 7 Section 9.5.6.6	

Chapter 16A - Structural Design Requirements

Stru2001 CBC	2003 NFPA 5000	Comments
1630A.10 Story Drift Limitation.	ASCE 7 Section 9.5.2.8 ASCE 7 Section 9.5.4.4 ASCE 7 Section 9.5.6.6 ASCE 7 Section 9.5.8.3	Amendment required. Permissible drifts depend on analysis method
1630A.10.1 General.	ASCE 7 Section 9.5.5.7	
1630A.10.2 Calculated.		
1630A.10.3 Limitations.		
1630A.11 Vertical Component.	ASCE 7 Section 9.5.2.6.4.3	
SECTION 1631A . DYNAMIC ANALYSIS PROCEDURES **1631A.1 General.**	ASCE 7 Section 9.5.6	Dynamic procedures cover only the modal analysis. Other requirements (ground motion, detail requirements) not tied to procedure
1631A.2 Ground Motion.	ASCE 7 Section 9.4.1.2.6	May require amendment
1631A.3 Mathematical Model.	ASCE 7 Section 9.5.6.2	
1631A.4 Description of Analysis Procedures.		
1631A.4.1 Response spectrum analysis.		
1631A.4.2 Time-history analysis.	ASCE 7 9.5.8	Amendment required. ASCE 7 permits nonlinear response history analysis
1631A.5 Response Spectrum Analysis.	ASCE 7 Section 9.5.6	
1631A.5.1 Response spectrum representation and interpretation of results.	ASCE 7 Section 9.5.6. ASCE 7 Section 9.5.6.7	
1631A.5.2 Number of modes.	ASCE 7 Section 9.5.6.3	
1631A.5.3 Combining modes.	ASCE 7 Section 9.5.6.6	
1631A.5.4 Reduction of Elastic Response Parameters for design.	ASCE 7 Section 9.5.6.5	Amendment may be required
1631A.5.5 Directional effects.	ASCE 7 Section 9.5.2.5.2 ASCE 7 Section 9.5.2.6.2.4	Amendment may be required. Requirements vary with SDC
1631A.5.6 Torsion.	ASCE 7 Section 9.5.5.4	Amendment may be required
1631A.5.7 Dual systems.	ASCE 7 Section 9.5.2.2.1	Amendment required
1631A.6 Time-history Analysis. **1632A.1 General.**	ASCE 7 Section 9.5.7	Detailed review needed
1631A.6.1 Time history.	ASCE 7 Section 9.5.7.2	
1631A.6.2 Elastic time-history analysis.	ASCE 7 Section 9.5.7.2 ASCE 7 Section 9.5.7.3	
1631A.6.3 Nonlinear time-history analysis.	ASCE 7 Section 9.5.8	Extensive review needed. Amendments likely to be required
1631A.6.3.1 Nonlinear time history.	ASCE 7 Section 9.5.8	
1631A.6.3.2 Design review. *[Not adopted by OSHPD]*	ASCE 7 Section 9.5.8.4	Amendment required
SECTION 1632A . LATERAL FORCE ON ELEMENTS OF STRUCTURES, NONSTRUCTURAL COMPONENTS AND EQUIPMENT SUPPORTED BY STRUCTURES	ASCE 7 Section 9.6	Significantly more detail in ASCE 7. Extensive coverage of architectural elements including glazing and curtain walls. Some amendments required for OSHPD performance objectives
1632A.1 General.	ASCE 7 Section 9.6.1	
1632A.2 Design for Total Lateral Force.	ASCE 7 Section 9.6.1.3	
1632A.3 Specifying Lateral Forces.	ASCE 7 Section 9.6.1	
1632A.4 Relative Motion of Equipment Attachments.	ASCE 7 Section 9.6.1.4	
1632A.5 Alternative Designs.	ASCE 7 Section 9.6.3.15	Some amendments required
1632A.6 HVAC Ductwork, Plumbing/Piping and Conduit Systems.	ASCE 7 Section 9.6.3	Some amendments required
SECTION 1633A . DETAILED SYSTEMS DESIGN REQUIREMENTS **1633A.1 General.**	ASCE 7 Section 9.5.2.2.4.3 ASCE 7 Section 9.5.2.6	
1633A.2 Structural Framing Systems. **1633A.2.1 General.**	ASCE 7 Section 9.5.2.2	Amendments required
1633A.2.2 Detailing for combinations of systems.	ASCE 7 Section 9.5.2.2.2	Amendments required

Chapter 16A - Structural Design Requirements

Stru2001 CBC	2003 NFPA 5000	Comments
1633A.2.3 Connections		Amendments required
1633A.2.4 Deformation compatibility.	ASCE 7 Section 9.5.2.2.4.3	
1633A.2.4.1 Adjoining rigid elements.	ASCE 7 Section 9.5.2.2.4.2	
1633A.2.4.2 Exterior elements.	ASCE 7 Section 9.6.2.4	
1633A.2.5 Ties and continuity.	ASCE 7 Section 9.5.2.6.1.1	Amendments required. Varies with SDC
1633A.2.6 Collector elements.	ASCE 7 Section 9.5.2.6.2.6 ASCE 7 Section 9.5.2.6.3.1 ASCE 7 Section 9.5.2.6.4.1	Amendments required. Varies with SDC
1633A.2.7 Concrete frames.	ASCE 7 Table 9.5.2.2	Amendments required. Varies with SDC
1633A.2.8 Anchorage of concrete or masonry walls.	ASCE 7 Section 9.5.2.6.1.2 ASCE 7 Section 9.5.2.6.2.8 ASCE 7 Section 9.5.2.6.3.2	Amendments required. Varies with SDC
1633A.2.8.1 Out-of-plane wall anchorage to flexible diaphragms	ASCE 7 Section 9.5.2.6.3.2	Amendments required. Varies with SDC
1633A.2.9 Diaphragms.	ASCE 7 Section 9.5.2.6.2.7 ASCE 7 Section 9.5.2.6.4.4	Amendments required. Varies with SDC
1633A.2.10 Framing below the base.	ASCE 7 Section 9.5.7	Amendments required
1633A.2.11 Building separations.	ASCE 7 Section 9.5.2.8	Amendments required
1633A.2.12 Foundations and superstructure-to-foundation connections.	ASCE 7 Section 9.5.7	Amendments required. Varies with SDC
1633A.2.13 Requirements for elevators.	ASCE 7 Section 9.6.3.16	Amendments required
SECTION 1634A . NONBUILDING STRUCTURES	ASCE 7 Section 9.14	ASCE 7 provisions far more extensive. Detailed review and some amendments required
SECTION 1635A . EARTHQUAKE-RECORDING INSTRUMENTATIONS		Amendments required
Division V. SOIL PROFILE TYPES SECTION 1636A . SITE CATEGORIZATION PROCEDURE	ASCE 7 Section 9.4.1.2	
1636A.1 Scope.	ASCE 7 Section 9.4.1.2	
1636A.2 Definitions	ASCE 7 Section 9.4.1.2.1	
1636A.2.1 Average shear wave velocity.	ASCE 7 Section 9.4.1.2.2.2	
1636A.2.2 average field standard penetration resistance and average standard penetration resistance for cohesionless soil layers.	ASCE 7 Section 9.4.1.2.3	
1636A.2.3 Average undrained shear strength.	ASCE 7 Section 9.4.1.2.3	
1636A.2.4 Soft clay profile,	ASCE 7 Section 9.4.1.2.2	
1636A.2.5 Soil profiles	ASCE 7 Section 9.4.1.2.2	
1636A.2.6 Rock profiles	ASCE 7 Section 9.4.1.2.2	
SECTION 1637A . SITE DATA FOR STATE-OWNED OR STATE-LEASED ESSENTIAL SERVICES		Amendments required
SECTION 1638A [FOR OSHPD 1 & 4] . ADDITIONS, ALTERATIONS, REPAIRS AND SEISMIC RETROFIT TO EXISTING BUILDINGS OR STRUCTURES	NFPA 5000 Chapter 15	Extensive amendments required. Conflicts with statutory and regulatory requirements
Division VI-R .EARTHQUAKE EVALUATION AND DESIGN FOR RETROFIT OF [FOR BSC, DSA] EXISTING STATE-OWNED BUILDINGS [FOR OSHPD] EXISTING HOSPITAL BUILDINGS		No corresponding provisions.
	NFPA Section 35.4	Requirements for construction documents. Corresponds to requirements in the Administrative Code. Amendments

Chapter 16A - Structural Design Requirements

Stru2001 CBC	2003 NFPA 5000	Comments
		required.

Chapter 17A

Structural Tests and Inspections

Comparison Summary

The structural tests and Inspection chapters, Chapter 17 in the *IBC* and Chapter 40 of *NFPA 5000*, provide the regulations needed to assure that projects are properly constructed. The tests and inspection chapter plays a key role in the effort to achieve structural safety. These chapters set forth the nature and frequency of tests and inspections made during construction. The format and presentation of the structural tests and Inspection chapters in the two model codes vary significantly.

IBC 2003

Chapter 17 of the *IBC* is 15 pages long, and is divided into 15 sections. The chapter has been organized differently compared to the *CBC*, and includes extensive tables for each structural material that list the type and frequency of required tests, inspections, and special inspections. An excellent feature of these tables is the inclusion of specific citations to the appropriate code sections and referenced standard sections. This greatly simplifies the task of locating the appropriate information on the required test or inspection. Some tests and inspections are triggered by Seismic Design Category, a change from current OSHPD practice that applies uniform requirements state wide. The *IBC* contains specific observations that must be performed for wind design concerns, something not found in the *CBC*. *IBC* Chapter 17 contains a specific section on Material and Test Standards, a new feature to the model code that is currently covered through ICBO acceptance criteria.

In general, *IBC* Chapter 17 is an improvement over *CBC* Chapter 17, providing greater coverage of the subject in a much-improved format.

NFPA 5000

In *NFPA 5000*, structural tests and Inspection is covered in the 8 pages of Chapter 40. The overall philosophy and approach in *NFPA 5000* is significantly different from that found in either the *CBC* or the *IBC*. The Registered Design Professional (RDP) is given extensive authority over the Quality Assurance Program, establishing both the extent and frequency of tests and inspections. Minimum standards for frequency and extent of tests and inspections would have to be established by amendment, and coordinated with OSHPD's Part 1, Title 24 and other Part 2 provisions. While Chapter 40 provisions and *NFPA 5000* Section 1.7.6.6.3.4 (N) prescribe required special inspections; we could not locate qualification criteria or approval requirements for special inspectors (referred to as "Agent", per *NFPA 5000* Section 40.2.1) or material test laboratories.

NFPA 5000 Section 40.1.5 requires that the Owner directly or indirectly retain RDPs to prepare and administer quality assurance program. RDPs recommend inspectors (Agents) to the authority having jurisdiction. It is unclear who actually hires the

inspectors. The various tables in Chapter 40 provide only the “Item” and “Scope” of the object to be tested or inspected. There are no references to specific code sections or referenced publication sections.

Summary

IBC Chapter 17 covers structural tests and inspections in a more user-friendly manner, by providing direct references to test and inspection provisions. The lack of definition of a minimum scope and frequency of tests and inspections in *NFPA 5000* is a great concern. *NFPA 5000* Chapter 40 will require a significantly greater number of amendments to reach a level of performance comparable to that found in the *CBC* or *IBC* Chapter 17.

Chapter 17A - Structural Tests and Inspections

2001 CBC – Chapter 17A	IBC – Chapter 17	Comments
-	**1701 – GENERAL** 1.1 Scope – Covers quality, material and requirements for material.	Minimal effect
-	1.2 New materials 1.3 Used materials	IBC Sec. 1701.3 permits use of used materials, provided they meet code requirements for new materials No requirements for use of reclaimed materials are found in Chapter 17A of CBC. Requirements for use of reclaimed masonry are in Chapter 21A.
-	**1702 – DEFINITIONS**	Some definitions in IBC may need clarification. Approved Agency is defined as an established and recognized agency engaged in conducting tests and doing inspections
-	**1703 – APPROVALS** 1. Approved agency 1.1 Independent 1.2 Equipment 1.3 Personnel 3.2 Written approval 3.3 Approved record Building dept. to keep approvals on file and open to public inspect. 3.4 Performance 3.4.1 Research and investigation 3.4.2 Research reports	No effect to OSHPD program since Title 24 Part 1 provisions prescribe similar requirements.
1701A – SPECIAL INSPECTIONS A.1 General *A.1.2 Owner to employ special inspectors and project inspector*. *A.2.2. Qualification and approval of project and special inspectors*	**1704 – SPECIAL INSPECTIONS** 4.1 General.	IBC contains substantially more clarification of requirements for special inspections, no effect to OSHPD program due to provisions contained in Part 1, Title 24.
-	4.1.1 Building permit requirements	No effect to OSHPD program
A.3 Duties and Responsibilities of the *Project and* Special Inspectors *A.3.2 Inspector to observe work and submit verified reports*	4.1.2 Inspection report requirements	No effect to OSHPD program

Chapter 17A - Structural Tests and Inspections

2001 CBC – Chapter 17A	IBC – Chapter 17	Comments
A.4 Standards of Quality Concrete – ASTM C94 Connections - ASTM A325 or A490 Spray-applied Fire-resistive Materials – UBC Standard 7-6	See 1704 provisions and tables for material types	Similar
A.5 Types of Work Requiring Constant Presence of the Project or Special inspector Item 1. Concrete Item 2. Bolts installed in concrete	4.4 Concrete construction. Special inspection Except for: Pad footings for buildings 3 Stories Continuous wall footings for buildings 3 Stories Concrete or Masonry foundation walls constructed per 36.6.2 4.4.1 Materials test in absence of sufficient documentation of conformance with ACI 318-Chapter 3	Similar
Item 3. Special moment-resisting concrete frame	TABLE 1704.4 - REQUIRED VERIFICATION AND INSPECTION OF CONCRETE CONSTRUCTION	Continuous inspection in both IBC and CBC. No effect.
Item 4. Reinforcing steel and prestressing steel tendons	TABLE 1704.4	No specific requirements in IBC.
Welding Reinforcing steel	1704.4 Concrete Construction Item 2 of TABLE 1704.4	Periodic placement of reinforcement steel including prestressing tendons required by IBC, continuous by CBC.
Item 5. Structural welding. General. Special moment-resisting steel frames.	1704.3 Steel construction 4.3.1 Welding 4.3.2 Details 4.3.3.1 General 4.3.3.2 Periodic monitoring 4.3.3.3 Cont. monitoring TABLE 1704.3 - REQUIRED VERIFICATION AND INSPECTION OF STEEL CONSTRUCTION	Similar; IBC provides more clarity of required tests & inspections
6. High-strength bolting	4.3.3 High-strength bolts TABLE 1704.4 and 1704.3	Similar
7. Structural masonry & 2105A Quality Assurance	4.5 Masonry construction. 4.5.1 Empirically designed masonry, glass unit masonry and masonry veneer in essential facilities. 4.5.2 Engineered masonry in nonessential facilities	Continuous inspection for welds except single pass welds and metal decking. Continuous or periodic inspection for slip critical bolts depending on method of tightening.

Chapter 17A - Structural Tests and Inspections

2001 CBC – Chapter 17A	IBC – Chapter 17	Comments
	4.5.3 Engineered masonry in essential facilities	
8. Reinforced gypsum concrete	TABLE 1704.5.1 - LEVEL 1 SPECIAL INSPECTION TABLE 1704.5.3 - LEVEL 2 SPECIAL INSPECTION	Scope of test and inspection in IBC is greater than CBC.
9. Insulating concrete fill.	-	No provisions found in IBC
10. Spray-applied fire-resistive materials	4.11 Sprayed fire-resistant materials 4.11.1 Structural member surface conditions 4.11.2 Application. 4.11.3 Thickness 4.11.4 Density. 4.11.5 Bond strength	Similar – IBC provides more clarity of required tests/inspections
11. Piling, drilled piers and caissons	4.8 Pile foundations 4.9 Pier foundations	Similar
12. Shotcrete	1704.4 Concrete Construction Item 6 – Table 1704.4	Similar
13. Special grading, excavation and filling	1704.7 Soils. EXCEPT placement of fill less than 12 inches deep. 4.7.1 Site preparation 4.7.2 During fill placement 4.7.3 Evaluation of in-place density	Similar
14. Smoke-control system	1704.14 Special inspection for smoke control. 4.14.1 Testing scope 1. leakage testing prior to concealment 2. Prior to occupancy 4.14.2 Qualifications	Similar
15. Special cases	4.13 Special cases. Special inspections for work in the opinion of the building official is unusual in nature	Similar
16. Manufactured trusses OSHPD amendment provision		Continue OSHPD amendment
17. Glued-laminated Timber OSHPD amendment provision	-	Continue OSHPD amendment
18. Post Installed Anchors. OSHPD amendment provision	-	Continue OSHPD amendment
-	4.6 Wood construction. 4.6.1 Fabrication of High-Load	No effect to OSHPD program

Chapter 17A - Structural Tests and Inspections

2001 CBC – Chapter 17A	IBC – Chapter 17	Comments
	Diaphragms	
	4.10 Wall panels and veneers 4.12 Exterior insulation and finish systems (EIFS)	No effect to OSHPD program
SECTION 1702A . OBSERVATION OF THECONSTRUCTION -		Continue OSHPD amendment
SECTION 1703A . NONDESTRUCTIVE TESTING	-	Continue OSHPD amendment
1704A – PREFABRICATED CONSTRUCTION	1704.2 Inspection of Fabricators	Similar
-	3.5 Labeling 3.5.1 Testing 3.5.2 Inspection and Identification 3.5.3 Label information.	No specific requirements for labeling in CBC chapter 17A. There are some requirements in the product sections of the CBC. (e.g. Glued-Laminated Timbers – Section 2337A.1)
A.1 General A.1.1 Purpose A.1.2 Scope – all prefabricated construction A.1.3 Definition of prefabricated assembly A.2 Tests of Materials A.3 Tests of Assemblies A.4 Connections A.5 Pipes and Conduits A.6 Certificate and Inspection A.6.1 Materials A.6.2 Certificate A.6.3 Certifying agency A.6.4 Field erection A.6.5 *Constant* inspection	3.6 Heretofore approved materials 3.7 Evaluation and follow-up inspection services. 3.7.1 Follow-up inspection. 3.7.2 Test and inspection records 4.2 Inspection of fabricators. 4.2.1 Fabrication and implementation procedures 4.2.2 Fabricator approval.	No effect to OSHPD program; Title 24 Part 1 provisions similar.
-	**1705 – QUALITY ASSURANCE FOR SEISMIC RESISTANCE** 5.1 Scope 5.2 Quality assurance plan preparation. each designated seismic system shall include a quality assurance plan prepared by a registered design professional	No provisions in CBC specific to a particular seismic zone. Minimal impact to OSHPD program.

2001 CBC – Chapter 17A	IBC – Chapter 17	Comments
	5.3 Contractor responsibility. submit a written contractor's statement of responsibility to the building official and to the owner	
-	**1706 – QUALITY ASSURANCE FOR WIND REQUIREMENTS** 6.1 Scope quality assurance plan 6.1.1 When required 1. Wind exposure categories A and B, 3-second-gust wind speed is 120 mph or greater. 2. Wind exposure categories C and D, 3-second-gust wind speed is 110 mph or greater. 6.1.2 Detailed requirements. 6.2 Quality assurance plan preparation. each main wind-force-resisting system and component shall include a quality assurance plan 6.3 Contractor responsibility. shall submit a written contractor's statement of responsibility to the building official and owner	No provisions in CBC specific to a particular wind zone. Minimal impact to OSHPD program.
-	**1707 – SPECIAL INSPECTIONS FOR SEISMIC RESISTANCE** 7.1 Special inspections for seismic resistance. 7.2 Structural steel 7.3 Structural wood 7.4 Cold-formed steel framing 7.5 Storage racks and access floors 7.6 Architectural components 7.7 Mechanical and electrical 7.7.1 Component inspection. 7.7.2 Component and attachment testing. 7.7.3 Component manufacturer certification.	No provisions in CBC specific to a particular seismic zone. Some systems are regulated under the IBC and not regulated under the CBC. Minimal impact to OSHPD program.

Chapter 17A - Structural Tests and Inspections

2001 CBC – Chapter 17A	IBC – Chapter 17	Comments
	7.8 Seismic isolation system.	
1703A – NONDESTRUCTIVE TESTING *A.1* Welded, fully restrained connections …ordinary moment frames and special moment-resisting frames	**1708 – STRUCTURAL TESTING FOR SEISMIC RESISTANCE** 1708.1 Masonry 1708.1.1 Empirically designed masonry and glass unit masonry in nonessential facilities 1708.1.2 Empirically designed masonry and glass unit masonry in essential facilities 1708.1.3 Engineered masonry in nonessential facilities 1708.1.4 Engineered masonry in essential facilities. 1708.2 Testing for seismic resistance 1708.3 Reinforcing and prestressing steel. TABLE 1708.1.2 - LEVEL 1 QUALITY ASSURANCE TABLE 1708.1.4 - LEVEL 2 QUALITY ASSURANCE 1708.4 Structural steel 1708.5 Mechanical and electrical equipment 1708.6 Seismically isolated structures. For required system tests, see 9.13.9 of ASCE 7.	Provisions in CBC are not triggered by seismicity. Scope of test and inspection in IBC is greater than CBC, but not greater than OSHPD-amended code provisions. No effect to OSHPD program.
1702A – OBSERVATION OF THE CONSTRUCTION A.1 (OSHPD) references Title 24, Part 1 Sec. 4-333 and 4-341	**1709 – STRUCTURAL OBSERVATIONS** 1709.1 Structural observations. Structural observations shall be provided for those structures included in Seismic Design Category D, E or F. Structural observations shall also be provided for those structures sited where the basic wind speed exceeds 110 miles per …	There are no specific requirements in the CBC for structural observation in areas of high seismicity and wind. It appears structural observation is only required by the IBC under this section. Minimal impact to OSHPD program.
-	**1710 - DESIGN STRENGTHS**	CBC provisions contained in material

2001 CBC – Chapter 17A	IBC – Chapter 17	Comments
	OF MATERIALS 10.1 Conformance to standards 10.2 New materials	chapters, no significant effect to OSHPD program.
-	**1711 – ALTERNATIVE TEST PROCEDURE** 11.1 General. In the absence of approved rules or other approved standards	No requirements in CBC, but minimal impact to OSHPD program.
-	**1712 – TEST SAFE LOAD** 12.1 Where required. Where proposed construction is not capable of being designed by approved engineering analysis…	No requirements in CBC, minimal impact to OSHPD program.
-	**1713 – IN-SITU LOAD TESTS** 13.1 General. 13.2 Test standards-standards listed in Chapter 35 13.3 In-situ load tests 13.3.1 Load test procedure specified-standards listed in Chapter 35. 13.3.2 Load test procedure not specified procedure developed by a registered design professional that simulates applicable loading and deformation conditions	No requirements in CBC, minimal impact to OSHPD program.
-	**1714 – PRECONSTRUCTION LOAD TESTS** 14.1 General. 14.2 Load test procedures specified design standards listed in Chapter 35 14.3 Load test procedures not specified. simulate loading conditions specified in Chapter 16. 14.3.1 Test procedure. 1. The load at the deflection limitation given in 1714.3.2. 2. The failure load divided by 2.5. 3. The maximum load applied	No requirements in CBC, minimal impact to OSHPD program.

2001 CBC – Chapter 17A	IBC – Chapter 17	Comments
	divided by 2.5. 14.3.2 Deflection. limitations in 1604.3. 14.4 Wall and partition assemblies. Testing 14.5 Exterior window and door assemblies. design pressure rating determined 14.5.1 Aluminum, vinyl and wood exterior windows and glass doors. labeled 14.5.2 Exterior windows and door assemblies not provided for in 14.5.1 shall be tested 14.6 Test specimens	
-	**1715 – MATERIAL AND TEST STANDARDS** 15.1 Test standards for joist hangers and connectors. 15.1.1 Test standards for joist hangers 15.1.2 Vertical load capacity for joist hangers 15.1.3 Torsional moment capacity for joist hangers 15.1.4 Design value modifications for joist hangers 15.2 Concrete and clay roof tiles. 15.2.1 Overturning resistance 15.2.2 Wind tunnel testing	New to code, but currently addressed through acceptance criteria for structural hardware (ICBO AC), UBC Std. 15-5, etc., no significant differences from current requirements.

Chapter 17A - Structural Tests and Inspections

2001 CBC – Chapter 17A	NFPA 5000 – Chapter 40	Comments
-	**40.1 General** 40.1.1 Scope 40.1.2 Purpose	Chapter 40 prescribes requirements for quality assurance, defined per Sec. 40.2.4 to include tests, inspections, and observations. This scope is similar to CBC Ch. 17A scope. Amend Chapter 40 to remove conflicts with Title 24 Part 1 provisions applicable to OSHPD's program. Part 1 provisions are not specific as to required special inspections/tests, this is currently addressed in Chapter 17A, Part 2. Chapter 40 provisions and Section 1.7.6.6.3.4 (N) prescribe required special inspections; could not locate qualification criteria or approval requirements for special inspectors (agent, per 40.2.1) or material test laboratories. OSHPD will amend to continue current requirements for OSHPD program.
-	40.1.3 Extent of Quality Assurance 40.1.3.2 Registered Design Professional (RDP) shall determine the frequency and extent of the applicable tests, inspections, and observations required …	Minimum standards for frequency and extent must be established by amendment, coordinate with OSHPD's Part 1, Title 24 and other Part 2 provisions (e.g. materials chapters).
-	40.1.4 Structures Requiring Quality Assurance 40.1.4.1 Quality Assurance Programs in Seismic Design Categories C, D, E, and F. 40.1.4.2 Quality Assurance Programs in High Wind Zones.	No impact to OSHPD program, due to Part 1, Title 24 provisions, but amend to clarify.
-	40.1.4.3 Structures, Components, Assemblies, and Systems not Requiring a Quality Assurance Program. 1) Pad footings for buildings > 3 Stories 2) Continuous wall footings for buildings > 3 Stories … 3) Concrete or Masonry foundation walls constructed per 36.6.2	Repeal provision to remove conflict with OSHPD requirements contained in Title 24, Part 1.
1701A – SPECIAL INSPECTIONS A.1 General	40.1.5 Involvement of the Owner and Registered Design Professional	Owner to directly or indirectly (repeal "indirectly") retain registered Design Professionals (RDP) to prepare and administer quality assurance program.

Chapter 17A - Structural Tests and Inspections

2001 CBC – Chapter 17A	NFPA 5000 – Chapter 40	Comments
A.1.2 Special Inspectors in addition to project inspector. A.2 *Project and* Special Inspector *A.2.2 Inspector Qualifications*		RDP(s) recommend inspectors (Agents) to the authority having jurisdiction. It is unclear who actually hires the inspectors.
-	40.1.6 Responsibility of the Contractor 40.1.7 Building Permit	No provisions in current CBC Vol. 2. Enforcement role with QC plan new to code. Evaluate and determine whether or not to amend to clarify.
A.3 Duties and Responsibilities of the *Project and* Special Inspectors *A.3.2 Inspector to observe work and submit verified reports*	40.1.8 Reports 40.1.9 Remedial Action 40.1.10 Final Report	Registered design professional (RDP) provides final report. Amend 40.1.8 to require all test/inspection reports to be sent to OSHPD as well as RDP.
-	40.1.11 Performance Specification	Amend to require approval by OSHPD of contractor-designed components, assemblies or systems.
-	**40.2 Special Definitions**	Some definitions in NFPA may need clarification. Agent defined as qualified company or individual assigned to execute a specific test, inspection or observation.
A.4 Standards of Quality Concrete – ASTM C94 Connections - ASTM A325 or A490 Spray-applied Fire-resistive Materials – UBC Standard 7-6	Addressed in material provisions Referenced In ACI 318 - **40.5 Quality Assurance for Sprayed Fire-Resistive Materials**	Similar
1702A – OBSERVATION OF THE *CONSTRUCTION* *A.1- Observation by Architect or Engineer in responsible charge.*	**40.3 Quality Assurance for Structural Components and assemblies** 40.3.1 Scope 40.3.2 Structural Observation 40.3.3 Structural Test and Inspections 40.3.4 Inspection of Fabricators 40.3.4.2 Inspection During Fabrication	Amend to comply with Title 24, Part 1 provisions.
1701A.5 Types of Work *Requiring Constant Presence of the Project or Special inspection*	40.3.7 Cast-in-Place Concrete Construction Table 40.3.7 Cast-in-Place Concrete Construction	Frequency of testing determined by RDP, amend to comply with CBC requirements, which are specific (e.g. concrete sampling, masonry core tests, reinforcement steel

Chapter 17A - Structural Tests and Inspections

2001 CBC – Chapter 17A	NFPA 5000 – Chapter 40	Comments
1. Concrete 2. Bolts installed in concrete	Concrete Construction Table 40.3.8 Precast Concrete Construction	tests).
3. Special moment-resisting concrete frame	-	No specific requirements found in NFPA 5000, review ASCE 7-02.
4. Reinforcing steel and prestressing steel tendons Welding Reinforcing steel	Table 40.3.7 Cast-in-Place Concrete Construction	Frequency of testing determined by RDP, amend as noted above.
5. Structural welding. General. Special moment-resisting steel frames. Welding Reinforcing steel (see #4) 6. High-strength bolting	40.3.10 Steel Construction Table 40.3.10(a) Steel Construction	Frequency of testing determined by RDP, amend as noted above.
7. Structural masonry	40.3.9 Masonry Construction	Frequency of testing determined by RDP in NFPA. Amend ACI 530 Sec. 1.14 QA provisions to clarify QA program requirements and qualification criteria for material test laboratories and inspectors.
8. Reinforced gypsum concrete	41.8.3 Testing (Reinforced Gypsum Concrete)	Minimal impact
9. Insulating concrete fill.	-	No provisions found in NFPA
10. Spray-applied fire-resistive materials	**40.5 Quality Assurance for Sprayed Fire-Resistive Materials** Table 40.3.5.1.2 Sprayed Fire-Resistive Materials 40.5.2 Density 40.5.3 Bond Strength	Frequency of testing determined by RDP in NFPA.
11. Piling, drilled piers and caissons	40.3.6 Foundations Table 40.3.6(a) Pile Foundations Table 40.3.6(b) Pier Foundations	Frequency of testing determined by RDP in NFPA.
12. Shotcrete	Table 40.3.7 Cast-in-Place Concrete Construction	Frequency of testing determined by RDP in NFPA.
13. Special grading, excavation and filling	40.3.5 In-situ Soils and Controlled Structural Fill Table 40.3.5.1 In-situ Bearing Strata for Footings	Frequency of testing determined by RDP in NFPA.

Chapter 17A - Structural Tests and Inspections

2001 CBC – Chapter 17A	NFPA 5000 – Chapter 40	Comments
	Table 40.3.5.2 Controlled Structural Fill (Prepared Fill)	
14. Smoke-control system	40.6 Quality Assurance for Smoke Control Systems	Quality assurance program prepared by RDP in NFPA.
15. Special cases	40.3.12 Special Cases	
16. Manufactured trusses 17. Glued-laminated Timber	40.3.11 Wood Construction Table 40.3.11 Wood Construction	Frequency of testing determined by RDP in NFPA.
18. Post Installed Anchors.	Table 40.3.10(a) Steel Construction - Item 11.	Frequency of testing determined by RDP in NFPA.
-	Table 40.3.10(b) Light-Framed Cold-formed Steel Construction	Frequency of testing determined by RDP in NFPA.
-	**40.4 Quality Assurance for Wall Finish Systems** 40.4.1 Scope 40.4.2 Exterior Insulation and Finish Systems (EIFS)	No specific requirements in CBC. Within scope of project inspector's work. Minimal impact.
-	**40.7 Quality Assurance for Stairs and Railings**	
-	**40.8 Quality Assurance for Nonstrucutral Componnets and Systems.** ASCE 7, Section A9.3.	
-	**40.9 Quality Assurance for Penetrations and Joints**	
SECTION 1702A . OBSERVATION OF THE CONSTRUCTION		Continue OSHPD amendment
1703A – NONDESTRUCTIVE TESTING *A.1* Welded, fully restrained connections …ordinary moment frames and special moment-resisting frames	-	No specific provisions in NFPA, see Table 40.3.10(a), refers to project specifications (which are not codified).
1704A – PREFABRICATED CONSTRUCTION	40.3.4.1 Prefabricated construction	Evaluate for amendment to clarify that material tests and inspections will be required as for site-constructed materials, and no waiving of requirements will be permitted by the RDP (see 40.3.4.1.1).

Chapter 18A
Foundations and Retaining Walls
Comparison Summary

The foundation design chapters, Chapter 18 (Soils and Foundations) in the *IBC* and Chapter 36 (Soils, Foundations, and Retaining Walls) of *NFPA 5000*, cover the design of foundations and earth-retaining structures.

IBC 2003

Chapter 18 of the *IBC* is 25 pages long. The chapter has been organized differently compared to the *CBC*, and includes greatly expanded coverage of foundation design. A useful feature of *CBC* Chapter 18 is the extensive cross-referencing provided, which directs the user to appropriate provisions in other chapters of the code. Seismic Design Category triggers many foundation design requirements. These triggers will require evaluation by OSHPD.

Coverage of deep foundation systems is much more extensive than in the *CBC.* The useful table of minimum foundation depth and thickness under light frame walls is retained. *IBC* provisions for unreinforced concrete and masonry basement walls will not be adopted for OSHPD's jurisdiction, and should be repealed for all other occupancies in California.

NFPA 5000

In *NFPA 5000*, soils, foundations, and retaining walls are covered in the 10 pages of Chapter 36. Chapter 36 contains provisions for a number of different types of foundation systems. A number of the provisions in Chapter 36 are vague. For example, Section 36.2.3.3 uses the phrase "safe side slopes, as determined by the AHJ", which seems to force the responsibility for determination of safe side slopes on to the building official. In Table 36.3.4(a), which gives permissible soil bearing values, the terms "soft", "medium", "hard", "compact", "loose" may be problematic for interpretation and use by typical users (non-geotechnical engineer) of these tables. In addition, there are no permissible bearing values for gravel and rock sites.

Many of the References in the Chapter 36 appear overbroad. For example, Section 36.1.1 states that foundations must meet ASCE7-02, Sections 9 and A9.7, over 100 pages of material (the entire Seismic Design Section). Section 36.9.1, retaining walls, stated that they shall be designed to resist design loads in Chapter 35, and to insure stability against overturning, sliding, excessive foundation pressure, and water uplift. Again reference is made to the entire Chapter. Further, the requirements are vague. What constitutes "excessive foundation pressure?" More precise language is needed. Another example is steel piles, covered in Section 36.5.7. Basically, this section requires that steel piles meet the requirements of Chapter 44, the steel chapter. Unfortunately, we could not locate any piling requirements in Chapter 44. Therefore,

the user would have to begin searching the referenced publications for the appropriate provision. In contrast, users of the *IBC* need only refer to Section 1809.3, which provides specific materials, allowable stress, and dimension information.

Summary

IBC Chapter 18 covers soils and foundations in a more comprehensive, precise, and enforceable manner than *NFPA 5000* Chapter 40. The overly broad references are especially troubling, as they force both the designer and building official to search through large volumes materials to find applicable provisions. This makes *NFPA 5000* significantly more difficult to use and enforce. In addition, provisions will need to be added to *NFPA 5000* to address frost protection, footings on or adjacent to slopes, footing widths for light frame construction, design for expansive soil, pier foundations, and permissible bearing values for gravel and rock sites.

Chapter 18A - Foundations and Retaining Walls

2001 CBC – Chapter 18A	IBC – Chapter 18	Comments
Division I - General **1801A – Scope** References App. Chapter 33A, UBC Std. 18-1 (soils classification), UBC Std. 18-2 (expansion index test)	**1801 - General**	Similar
1802A - Quality and Design Refers to App. Ch. 33	1801.2 Design	Similar
1803A - Soil Classification - Expansive Soil	1802.2.2 Expansive Soils	Similar; note that UBC Standards 18-1 and 18-2 discontinued
1804A - Foundation Investigation A.1 General. OSHPD amends re: required geotechnical investigation A.2 Investigation. OSHPD amends re: minimum # of borings, liquefaction analysis A.3 Reports. OSHPD amends re: liquefaction, high sulfate soils A.4 Expansive Soils. A.5 Liquefaction Potential. A.6 Adjacent Loads. A.7 Drainage.	**1802 – Foundation and Soils Investigations** 2.1 General 2.2 Where required (exception clause) 2.2.1 Questionable soil 2.2.2 Expansive soils 2.2.3 Ground-water table 2.2.4 Pile and pier foundation 2.2.5 Rock strata 2.2.6 SDC C 2.2.7 SDC D, E, F 2.3 Soil classification 2.4 Investigation 2.5 Soil boring and sampling 2.6 Reports 1803.3 Site grading (addresses A.7 provision pertaining to drainage around buildings)	Similar, continue OSHPD amendments; evaluate SDC "C" provisions for non-adoption
3301 – Excavations and Fills 1.1 General 1.2 Protection of adjoining property (see IBC 3307 for correlated provisions) *1.3 Protection of existing buildings* (OSHPD amendment, continue in 2004 CBC)	**1803 – Excavation, Grading and Fill** 3.1 Excavations near footings or foundations 3.2 Placement of backfill 3.3 Site grading 3.4 Grading and fill in floodways 3.5 Compacted fill material 3.6 Controlled low-strength material (CLSM)	Similar; continue OSHPD amendments to 3301
1805A - Allowable Foundation and Lateral Pressures Requires report based on bldg. Size, type of const. and loads	**1804 – Allowable Load-Bearing Values of Soils** 4.1 Design 4.2 Presumptive load-bearing values 4.3 Lateral sliding resistance Table 1804.2 Allowable Foundation and Lateral Pressure	Similar (no OSHPD amendments to this CBC section)

Chapter 18A - Foundations and Retaining Walls

2001 CBC – Chapter 18A	IBC – Chapter 18	Comments
1806A - Footings A.1 General. OSHPD amends re: unformed footing size	**1805 – Footings and Foundations** 5.1 General 1805.4.2.6 Forming of concrete	Similar, continue OSHPD amendments (amend 1805.4.2.6)
A.2 Footing Design. OSHPD amends re: elastic analysis. Model code provision refers to Div. III for slab/mat structure on expansive soils	5.4 Footings 1805.8 Design for expansive soils 1805.8.1 Foundations 1805.8.2 Slab-on-grade foundations 1805.8.3 Removal of expansive soil 1805.8.4 Stabilization	Similar, continue OSHPD amendment Evaluate 1805.8 for adoption/amendment
A.3 Bearing Walls. OSHPD amends to require shear wall footing to meet bearing wall footing requirements.	5.2 Depth of footings 5.4 Footings	Similar, continue OSHPD amendment
A.4 Stepped Foundations. OSHPD amends to limit step dimensions, detailing.	5.1 General	Continue OSHPD amendment
A.5 Footings on or Adjacent to Slopes. 1. scope 2. clearance from ascending slope 3. setback from descending slope 4. pools (setback from pool wall) 5. foundation elevation (drainage) 6. alternate setback and clearance	5.3 Footings on or adjacent to slopes 1. Building clearance from ascending slopes 2. Footing setback from descending slope surface 3. Pools 4. Foundation elevation 5. Alternate setback and clearance	Similar
A.6 Foundation Plates or Sills. 1. DSA amend. 2. sills at bearing and shear walls, OSHPD amends to ref. 2320A.6 3. Additional requirements for Seismic Zones 3 and 4 - 2x2x 3/16 plate washers	1805.6 Foundation plate or sill bolting (refers to Chapter 23, does not contain any other provisions)	CBC provision not continued in IBC Chapter 18, refer to 2308.6 Continue OSHPD amendment in 2308.6
A.7 Seismic Zone 3 and 4. Requires #4 cont. top and bottom at foundation.	1805.9 Seismic requirements Refers to Sec. 1910	IBC provisions differ from CBC due to SDC; also see Chapter 19 Evaluate for amendment; repeal exception 1. and 2.
A.8 Designs Employing Lateral Bearing. 1. general (OSHPD amends re: pile and caisson elastic deformation) 2. design criteria; non-constrained and constrained 3. backfill 4. limitations	1805.7 Designs employing lateral bearing 1. Limitation 2. Design criteria; non-constrained and constrained 3. Backfill 1812 - Pier Foundations (see below)	Similar IBC provisions contained in 1812 are new (see below)

Chapter 18A - Foundations and Retaining Walls

2001 CBC – Chapter 18A	IBC – Chapter 18	Comments
A.9 Gillage Footings.	1805.4.4 Steel grillage footings	Similar
A.10 Bleacher Footings	-	No provisions found; evaluate for amendment
A.11 Pipes and Trenches (OSHPD amendment re: trench setback, sleeved pipes)	-	Continue OSHPD amendment
-	1805.4.2.3 Plain concrete footings	Do not adopt
-	1805.4.2.4 Placement of concrete	Adopt
-	1805.4.2.5 Protection of concrete	Adopt
-	1805.4.3 Masonry-unit footings	Evaluate
-	1805.4.5 Timber footings	Do not adopt
-	1805.4.6 Wood foundations	Do not adopt
-	1805.5 Foundation walls includes sections 1805.5.1 through 1805.5.7 and Tables 1805.5 (1) through (4)	Do not adopt (these provisions are new to code and provide for non-engineered basement walls)
1611A.6 Retaining Walls	1806 – Retaining Walls	Continue amendments of 1611A.6 in 1806
-	1807 Dampproofing and Waterproofing	New provisions to model code – evaluate for adoption
1807A - Piles - General Requirements	**1808 – Pier and Pile Foundations**	IBC provisions more extension, updated
A.1 General.	1. Definitions 2. Piers and Piles – General Requirements 2.1 Design 2.2 General 2.3 Special types of piles	IBC provisions more extensive, definitions new to model code
A.2 Interconnection	2.4 Pile caps	Similar
A.3 Determination of Allowable Loads A.4 Static Load Tests.	2.8 Allowable pier or pile loads - driving criteria - load tests - load test evaluation - allowable frictional resistance - uplift capacity - load bearing capacity - bent piers or piles - overloads on piers or piles	IBC provisions more extensive, updated
A.5 Column Action.	2.9 Lateral support	Similar
A.6 Group Action.	1808.2.2; item 9.	Similar
A.7 Piles in Subsiding Areas.	2.11 Piles in subsiding areas	Similar
A.8 Jetting.	2.13 Pre-excavation	Similar
A.9 Protection of Pile Materials.	2.17 Protection of pile materials	Similar
A.10 Allowable Loads.	2.8 Allowable pier or pile loads	Similar

2001 CBC – Chapter 18A	IBC – Chapter 18	Comments
	also see 1808.2.8.4 (allowable frictional resistance)	
A.11 Use of Higher Allowable Pile Stresses.	2.10 Use of higher allowable pier or pile stresses	Similar
-	1808.2: 2.5 Stability 2.6 Structural integrity 2.7 Splices 2.12 Settlement analysis 2.14 Installation sequence 2.15 Use of vibratory drivers 2.16 Pile drivability 2.18 Use of existing piers or piles 2.19 Heaved piles 2.20 Identification 2.21 Pier or pile location plan 2.22 Special inspection 2.23 Seismic design of piers or piles (based on SDC, whether C, or D, E, F)	IBC contains new provisions, evaluate and adopt
1808A - Specific Pile Requirements	**1809 - Driven Pile Foundations**	IBC provisions more extension, updated
A.1 Round Wood Piles. 1.1 Material 1.2 Allowable stresses	1809.1 Timber piles 1.1 Materials 1.2 Preservative treatment 1.3 End-supported piles	Similar, IBC provisions updated, reference AF & PA NDS for design, ASTM D 25 and DOC PS-20 for material, and AWPA C3 for treatment
A.2 Uncased C-I-P Concrete Piles 2.1 Material 2.2 Allowable stresses	**1810 - Cast-in-Place Concrete Pile Foundations** 1810.1 General 1. Materials 2. Reinforcement (SDC-based provisions included) 3. Concrete placement 1810.2 Enlarged base piles 1. Materials 2. Allowable stresses 3. Installation 4. Load-bearing capacity 5. Concrete cover 1810.3 Drilled or augered uncased piles 1. Allowable stresses 2. Dimensions 3. Installation 4. Reinforcement 5. Reinforcement in SDC C, D, E or F	IBC provisions more extensive

2001 CBC – Chapter 18A	IBC – Chapter 18	Comments
A.3 Metal-cased Concrete Piles (both CIP and driven) 3.1 Material 3.2 Installation 3.3 Allowable stresses	1810.4 Driven uncased piles 1. Allowable stresses 2. Dimensions 3. Installation 4. Concrete cover 1810.5 Steel-cased piles 1. Materials 2. Allowable stresses 3. Installation 4. Reinforcement 1810.7 Caisson piles 1. Construction 2. Materials 3. Design 4. Structural core 5. Allowable stresses 6. Installation	Similar
A.4 Pre-cast Concrete Piles 4.1 Materials 4.2 Reinforcement ties 4.3 Allowable stresses	1809.2 Precast concrete piles 1. General 1.1 Design and manufacture 1.2 Minimum dimension 1.3 Reinforcement 2. Precast nonprestressed piles 2.1 Materials 2.2 Minimum reinforcement (SDC-based) 2.3 Allowable stresses 2.4 Installation 2.5 Concrete cover	IBC provisions more comprehensive, updated
A.5 Precast Prestressed Concrete Piles (Pretensioned) 5.1 Materials 5.2 Reinforcement 5.3 Allowable stresses	1809.2.3 Precast prestressed piles 1. Materials 2. Design (SDC-based) 3. Allowable stresses 4. Installation 5. Cover	IBC provisions more comprehensive, updated
A.6 Structural Steel Piles 6.1 Material 6.2 Allowable stresses 6.3 Minimum dimensions	1809.3 Structural steel piles 1. Materials 2. Allowable stresses 3. Dimensions of H-piles 4. Dimensions of steel pipe piles	Similar
A.7 Concrete-filled Steel Pipe Piles 7.1 Material 7.2 Allowable stresses 7.3 Minimum dimensions	1810.6 Concrete-filled steel pipe and tube piles 6.1 Materials 6.2 Allowable stresses 6.3 Minimum dimensions	Similar; IBC provisions updated

2001 CBC – Chapter 18A	IBC – Chapter 18	Comments
	6.4 Reinforcement 6.5 Placing concrete	
-	**1811 - Composite Piles** 1. General 2. Design 3. Limitation of load 4. Splices 5. Seismic reinforcement	New provisions - evaluate for adoption
1806A.8 provisions are related (see above)	**1812 - Pier Foundations** 1. General 2. Lateral dimensions and height 3. Materials 4. Reinforcement 5. Concrete placement 6. Belled bottoms 7. Masonry 8. Concrete 9. Steel shell 10. Dewatering	IBC 1812 provisions are new (primarily prescriptive construction requirements); evaluate for adoption and amendment
1809A - Foundation Construction - Seismic Zones 3 and 4 A.1 General.	1805.4.2.2 Footing seismic ties 1805.5.5 Seismic requirements (prescriptive foundation walls) 1805.9 Seismic requirements (foundations for SDC D, E, F)	IBC incorporates SDC-based seismic design provisions within each section
A.2 Soil Capacity.	1802.2.7 Seismic design category D, E, or F. (soils investigation)	Similar
A.3 Superstructure-to-Foundation Connection.	1805.9 references ACI 318-02, Section 21.8	Similar
A.4 Foundation-Soil Interface.	1801.2.1 Foundation design for seismic overturning	Similar
A.5 Special Requirements for Piles and Caissons - OSHPD amends for Sd, Se, Sf soils	1808.2.23 Seismic design of piers or piles 1809.2.2.2 Minimum reinforcement (pre-cast driven piles; SDC-based requirements) 1809.2.3 Pre-cast prestressed piles; see 1809.2.3.2.1 (SDC C), 1809.2.3.2.2 (SDC D, E, F) 1810.1.2 Reinforcement (CIP concrete pile); see 1810.1.2.1 for SDC C, 1810.1.2.2 for SDC D, E, F 1810.3.5 Reinforcement in SDC C, D, E, F (drilled or augered uncased piles) 1810.5.4.1 Seismic reinforcement (steel-cased piles) 1810.6.4.1 Seismic reinforcement	IBC contains more extensive requirements; evaluate for discontinuation of OSHPD amendments in CBC

2001 CBC – Chapter 18A	IBC – Chapter 18	Comments
	(concrete-filled steel pipe and tube piles) 1811.5 Seismic reinforcement (composite piles)	
A.6 Inspection of Piles (OSHPD amendment)	1808.2.22 Special Inspection	Continue OSHPD amendment
A.7 Inspection of Caissons (OSHPD amendment)	1808.2.22 Special Inspection	Continue OSHPD amendment
Table 18A-I-A Allowable Foundation and Lateral Pressure	**Table 1804.2** Allowable Foundation and Lateral Pressure	Similar
Table18A-I-B Classification of Expansive Soil	-	No effect to OSHPD program
Table 18A-I-C Foundations for Stud Bearing Walls - Minimum Requirements	**Table 1805.4.2** Footings Supporting Walls of light-Frame Construction	Similar
Figure 18A-I-1 Setback Dimensions	**Figure 1805.3.1** Foundation Clearances from Slopes	Similar
-	**Table 1805.5(1)** Plain Masonry and Plain Concrete Foundation Walls	Do not adopt prescriptive design provisions
-	**Table 1805.5(2)** 8-Inch Concrete and Masonry Foundation Walls with Reinforcing Where d > 5 inches	Do not adopt prescriptive design provisions
-	**Table 1805.5(3)** 10-Inch Concrete and Masonry Foundation Walls with Reinforcing Where d > 6.75 Inches	Do not adopt prescriptive design provisions
-	**Table 1805.5(4)** 12-Inch Concrete and Masonry Foundation Walls with Reinforcing Where d > 8.75 Inches	Do not adopt prescriptive design provisions

Chapter 18A - Foundations and Retaining Walls

2001 CBC – Chapter 18A	NFPA5000 – Chapter 36	Comments
Division I - General **1801A – Scope** References App. Chapter 33A, UBC Std. 18-1 (soils classification), UBC Std. 18-2 (expansion index test)	[Note - Chapter 36 is titled "Soils, Foundations, and Retaining Walls"] **36.1 Scope**	Similar
1802A - Quality and Design Refers to App. Ch. 33	-	No effect noted
3301 - Excavations and Fills 1.1 General 1.2 Protection of adjoining property *1.3 Protection of existing buildings* (OSHPD amendment, continue in 2004 CBC)	**36.2 Excavations** 1. Scope 2. Protection of Excavations 3. Permanent Excavations 4. Fill 5. Site preparation	Similar scope; continue OSHPD amendments Evaluate 36.2.3.3 regarding phrase "safe side slopes, as determined by the AHJ", may need to repeal or establish specific requirements (consult CDMG) Review 36.2.4.3.2 for non-adoption (note also does not prescribe a standard for compaction) Evaluate
1803A - Soil Classification - Expansive Soil	**36.3.3 Expansive Soils**	Similar
1804A - Foundation Investigation A.1 General. OSHPD amends re: required geotechnical investigation A.2 Investigation. OSHPD amends re: minimum # of borings, liquefaction analysis A.3 Reports. OSHPD amends re: liquefaction, high sulfate soils A.4 Expansive Soils. A.5 Liquefaction Potential. A.6 Adjacent Loads. A.7 Drainage.	**36.3 Investigation and Bearing Capacity of Soil** 1. Classification 2. Soil investigation 3. Expansive soils 4. Presumptive capacities Site drainage - see 36.8.5 Site Grading	Continue OSHPD amendments 36.3.2.1 and 36.3.2.2 require evaluation prior to adoption No provisions to assess seismic effects (loading on retaining or basement walls, liquefaction, differential settlement, etc.) For SDC C, D, E, F, ASCE 7-02 Sec. 9.7.4.1 requires investigation to address slope instability, liquefaction, spreading and surface rupture.
1805A - Allowable Foundation and Lateral Pressures Requires report based on bldg. Size, type of const. and loads	**36.3.4 Presumptive Capacities** Refers to Table 36.3.4(a) (allowable vertical load) and Table 36.3.4(b) (allowable lateral load)	Table 36.3.4(a) and (b) terms for "Class of Material" Terms "soft", "medium", "hard", "compact", "loose" may be problematic for interpretation and use by typical users (non-geotechnical engineer) of these tables - evaluate and consult with CDMG to determine whether or not OSHPD can adopt, and if amendment is needed Evaluate footnote (a) of Table 36.3.4(a) regarding "unusual soil or moisture conditions" to determine if amendment or interpretation is needed
1806A - Footings A.1 General. OSHPD amends re: unformed footing size	**36.4 Soil-Bearing Footings** 36.4.1 General Provisions 36.4.1.2. (excavations)	Continue OSHPD amendment in 36.4.1.2, amend 36.4.1.2.2 to indicate 12" <u>minimum</u>
A.2 Footing Design. OSHPD amends re: elastic analysis. Model code provision refers to Div. III for slab/mat structure on expansive soils	36.4.1.4 (slab, raft, mat foundations on expansive soils)	Continue OSHPD amendment in 36.4.1.1
A.3 Bearing Walls. OSHPD amends to require shear wall footing to meet bearing wall footing	-	Continue model code provision and amendment

2001 CBC – Chapter 18A	NFPA5000 – Chapter 36	Comments
requirements.		
A.4 Stepped Foundations. OSHPD amends to limit step dimensions, detailing.	36.4.1.3	NFPA does not allow 10% slope at bottom. Continue OSHPD amendment provisions
A.5 Footings on or Adjacent to Slopes. 1. scope 2. clearance from ascending slope 3. setback from descending slope 4. pools (setback from pool wall) 5. foundation elevation (drainage) 6. alternate setback and clearance	-	Develop amendments to continue CBC (model code) provisions
A.6 Foundation Plates or Sills. 1. DSA amend. 2. sills at bearing and shear walls, OSHPD amends to ref. 2320A.6 3. Additional requirements for Seismic Zones 3 and 4 - 2x2x 3/16 plate washers	36.6.3 Foundation Plate or sill bolting (makes general reference to Chapter 45; no specific provisions found in Chapter 45)	NFPA 5000 nor referenced standard (NDS) prescribe any minimum sill bolting requirements. Only addressed for 1 and 2 family dwellings if designed per AF&PA WFCM, but WFCM does not prescribe plate washer requirements. AF& PA Wind/Seismic Supplement prescribes minimum bolting for shear walls, and does prescribe plate washer requirements for designed shear walls. Develop amendments to maintain current provisions.
A.7 Seismic Zone 3 and 4. Requires #4 cont. top and bottom at foundation.	-	Continue CBC provisions as amendment in 2004 CBC
A.8 Designs Employing Lateral Bearing. 1. general (OSHPD amends re: pile and caisson elastic deformation) 2. design criteria; non-constrained and constrained 3. backfill 4. limitations	36.4.2 Design Using Lateral Bearing 36.4.3 Design Formula - No Constraint 36.4.4 Design Formula - Constrained	Similar; continue OSHPD amendment in CBC item 1.
-	36.4.5 Flood Hazard Areas	Evaluate prior to adoption, consult DWR
A.9 Gillage Footings.	-	Evaluate to determine if amendment needed
A.10 Bleacher Footings	-	Evaluate to determine if amendment needed (also see Chapter 35 provisions regarding bleachers)
A.11 Pipes and Trenches (OSHPD amendment re: trench setback, sleeved pipes)	-	Continue OSHPD amendments
1807A - Piles - General Requirements A.1 General. A.2 Interconnection A.3 Determination of Allowable Loads A.4 Static Load Tests. A.5 Column Action.	**36.5 Pile Foundations** 1. Conditions of use 2. Axial and lateral loads for piles 3. Driven piles 4. Wood piles 5. Precast concrete piles 6. Prestressed precast concrete piles	Amend 36.5.2 to prescribe geotechnical investigation/report requirements per CBC Evaluate 36.5.1.6 (interconnection of piles of min. 5% of pile load; CBC 1807A.2 is 10%, so min. design tie load is 1/2 of current requirement) Note: 36.1.1 specifies conformance with ASCE 7-02, Sec. 9.7.4.3 of ASCE 7-02 specifies 10% as minimum design load for SDC C or greater. NFPA 5000 Sec. 1.3.2 (precedence) states that NFPA 5000 provision would govern in case of conflict.

2001 CBC – Chapter 18A	NFPA5000 – Chapter 36	Comments
A.6 Group Action. A.7 Piles in Subsiding Areas. A.8 Jetting. A.9 Protection of Pile Materials. A.10 Allowable Loads. A.11 Use of Higher Allowable Pile Stresses.	7. Structural steel shapes 8. Cast-in-place concrete piles	Evaluate continuation of CBC 1807A Sec. A.7, A.9, A.11 as amendments to 2004 CBC Evaluate 36.5.2.1 (dynamic load test) for adoption
1808A - Specific Pile Requirements A.1 Round Wood Piles. A.2 Uncased C-I-P Concrete Piles A.3 Metal-cased Concrete Piles A.4 Pre-cast Concrete Piles A.5 Precast Prestressed Concrete Piles (Pretensioned) A.6 Structural Steel Piles A.7 Concrete-filled Steel Pipe Piles	36.5.3 Driven piles 36.5.4 Wood piles 36.5.5 Precast concrete piles 36.5.6 Prestressed precast concrete piles 36.5.7 Structural steel shapes 36.5.8 Cast-in-place concrete piles	Evaluate 36.5.3.1 - verify that plans and specifications are required per code to denote resistance/penetration requirements; should state "approved" plans CIP concrete pile provisions more comprehensive than CBC Structural steel pile requirements less than CBC - evaluate
-	**36.6 Foundation Walls** 1. General requirements - isolated piers - isolated piers substituted for interior foundation walls - flood hazard areas 2. Foundation wall thickness - minimum thickness for concrete and masonry walls - foundation walls not meeting parameters of Tables 36.6.2.2(a) through (d) - thickness based on walls supported - thickness based on soils loads, unbalanced backfill height, and wall height - rubble stone - foundation walls - alternative concrete or masonry foundation wall reinforcement 36.6.3 Foundation Plate or sill bolting 36.6.4 Masonry pier and curtain wall foundations	Do not adopt prescriptive provisions for foundation walls (36.6.1, 36.6.2, 36.6.4) Amend 36.6.3 (see comments above)
-	**36.7 Wood Foundation Systems**	Do not adopt Sec. 36.7
-	**36.8 Waterproofing and Dampproofing** 1. Waterproofing required 2. Dampproofing required	New provisions to model code - evaluate for adoption (except 36.8.5, site grading, is similar to CBC provisions regarding site drainage

2001 CBC – Chapter 18A	NFPA5000 – Chapter 36	Comments
	3. Foundation drain 4. Floor base 5. Site grading	
1611A.6 Retaining Walls	**36.9 Retaining Walls** 1. Design 2. Hydrostatic pressure 3. Concrete retaining walls 4. Reinforced masonry retaining walls 5. Segmental retaining walls (ref. NCMA *Design Manual for Segmented Retaining walls*	Continue amendments of 1611A.6 in 36.9 36.9.1 does not prescribe FOS for overturning, sliding, soil pressure, and uplift (amend to maintain current CBC requirements)
1809A - Foundation Construction - Seismic Zones 3 and 4 A.1 General. A.2 Soil Capacity. A.3 Superstructure-to-Foundation Connection. A.4 Foundation-Soil Interface. A.5 Special Requirements for Piles and Caissons - OSHPD amends for Sd, Se, Sf soils A.6 Inspection of Piles (OSHPD amendment) A.7 Inspection of Caissons (OSHPD amendment)	36.1.1 (refers to ASCE 7-02, Section 9 and A9.7 for SDC C, D, E, F locations) 36.6 (foundation wall) provisions reference ASCE 7 limitations (general reference)	Evaluate ASCE 7-02 provisions for any needed amendments Continue A.6, A.7 amendments
Table 18A-I-A Allowable Foundation and Lateral Pressure	**Table 36.3.4(a)** Maximum Allowable Soil Pressures **Table 36.3.4 (b)** Maximum Allowable Lateral Soil Pressures	Table 36.3.4(a) and (b) terms for "Class of Material" Terms "soft", "medium", "hard", "compact", "loose" may be problematic for interpretation and use by typical users (non-geotechnical engineer) of these tables - evaluate and consult with CDMG to determine whether or not OSHPD can adopt, and if amendment is needed Evaluate footnote (a) of Table 36.3.4(a) and (b) regarding "unusual soil or moisture conditions" to determine if amendment or interpretation is needed Table 36.3.4(b) does not contain lateral sliding coefficients and resistance data
Table18A-I-B Classification of Expansive Soil	-	No effect to OSHPD program
Table 18A-I-C Foundations for Stud Bearing Walls - Minimum Requirements	-	Evaluate for amendment; prescriptive requirements used for light-frame structures
Figure 18A-I-1 Setback Dimensions	-	Develop amendments to continue CBC provisions
-	**Table 36.6.2.2(a)** Plain Masonry and Plain Concrete Foundation Walls	Do not adopt

2001 CBC – Chapter 18A	NFPA5000 – Chapter 36	Comments
-	**Table 36.6.2.2(b)** 8-Inch Reinforced Concrete and Masonry Foundation Walls Where d is Greater Than or Equal to 5 Inches-Reinforced Masonry	Do not adopt
-	**Table 36.6.2.2(c)** 10-Inch Reinforced Concrete and Masonry Foundation Walls Where d is Greater Than or Equal to 6.75 Inches-Reinforced Masonry	Do not adopt
-	**Table 36.6.2.2(d)** 12-Inch Reinforced Concrete and Masonry Foundation Walls Where d is Greater Than or Equal to 8.75 Inches-Reinforced Masonry	Do not adopt

Chapter 19A
Concrete
Comparison Summary

The concrete design chapters, Chapter 19 in the *IBC* and Chapter 41 of *NFPA 5000*, cover the design of plain and reinforced concrete structures, as well as reinforced gypsum concrete.

IBC 2003

Chapter 19 of the *IBC* is 18 pages long, and is based on *ACI 318-02*, the national standard for concrete construction. Sections 1902 through 1907 reproduce chapters from *ACI 318*-02 that are of special use to field enforcement personnel. Section 1908 amends portions of *ACI 318-02* to enhance seismic safety. Section 1910 contains additional seismic provisions, for integrating *ACI 318-02* with provisions of Chapter 16 and, indirectly to *ASCE 7-02*. A very useful section in the *IBC* is the allowable stress design provisions for anchorage to concrete, including a table of allowable bolt values. This permits quick anchorage designs without the need to work through the lengthy computations required by Appendix D of *ACI 318*.

NFPA 5000

NFPA 5000 covers concrete design in the 1½ pages of Chapter 41. Chapter 41 also references *ACI 318-02*. Most of the provisions of Chapter 41 consist of *ACI 318-02* or other referenced publications. There are no specific provisions to coordinate *ASCE 7-02* with *ACI 318-02*.

Summary

IBC Chapter 19 covers concrete design in a more comprehensive and user friendly manner. The portions of *ACI 318-02* most useful to inspectors have been included in the code. An attempt has been made to coordinate and integrate the provisions *ACI 318-02* with a seismic design approach based on *ASCE 7-02.* Inclusion of an ASD method for anchorage to concrete, along with tabulated values for bolts, will greatly simplify typical anchorage computations. Very little information, beyond what is already provided in *ACI 318-02* is contained in *NFPA 5000* Chapter 41.

Chapter 19A - Concrete

2001 CBC – Chapter 19A	IBC – Chapter 19	Comments
Division I - GENERAL **1900A General**	**1901 - General**	Similar; general comment – IBC has simpler format (no Divisions, tables integrated with applicable sections)
A.1 Scope	1. Scope	Similar
A.2 General Requirements	2. Plain and Reinforced Concrete	Similar
A.3 Design Methods 1. Strength design (load and resistance factor design 2. Allowable stress design	3. Source and applicability (ACI 318)	Similar
A.4 Additional Design and Construction Requirements 1. Anchorage 2. Shotcrete 3. Reinforced gypsum concrete 4. Minimum slab thickness 5. [Not adopted by OSHPD] Unified design provisions for reinforced and prestressed concrete flexural and compression members 6. [Not adopted by OSHPD] Alternative load-factor combination and strength-reduction	1912 – Anchorage (ASD) 1913 – Anchorage (Strength) 1914 – Shotcrete 1915 – Reinforced Gypsum Concrete 1911 – Slab Provisions (see 1911.1 re: minimum thickness, and new provisions for vapor retarder)	Similar
Division II **1901A - Scope**	1901.2	CBC adopts ACI 318-95 and transcribes into the model code, with changes from 318-95 denoted in italics IBC adopts ACI 318-02 by reference (design provisions are not transcribed, but construction provisions are)
1902A - Definitions	**1902 - Definitions**	2001 CBC includes UBC amendments to ACI definitions (air-dry weight), OSHPD makes a few further amendments (e.g. wall pier)
1903A – Specifications for Tests and Materials	**1903 – Specifications for Tests and Materials**	Similar
A.0 Notation	-	No effect
A.1 Tests of Materials	1. General (tests)	Simiilar
A.2 Cement	2. Cement	Similar
A.3 Aggregates OSHPD has substantial amendments pertaining to aggregates	3. Aggregates	Similar
A.4 Water.	4. Water	Similar
A.5 Steel Reinforcement. OSHPD amendment re: welding bars	5. Steel Reinforcement	Similar, evaluate OSHPD amendment for continuation
A.6 Admixtures.	6. Admixtures	Similar, evaluate OSHPD amendment for continuation

2001 CBC – Chapter 19A	IBC – Chapter 19	Comments
OSHPD amendment re: fly ash		
A.7 Storage of Materials.	7. Storage of Materials	Similar
A.8 Concrete Testing.	1905.6.3, 1905.6.4	Similar
A.9 Concrete Mix.	1905.8	Similar
A.10 Welding	1903.5.2	Similar
A.11 Glass Fiber Reinforced Concrete	1903.8 Glass fiber reinforced concrete	Similar
1904A – Durability Requirements	**1904A – Durability Requirements**	Similar
A.0 Notation	-	No effect
A.1 Water-Cementitious Materials Ratio	1. Water-Cementitious Materials Ratio	Similar
A.2 Freezing and Thawing Exposures.	2. Freezing and Thawing Exposures	Similar
A.3 Sulfate Exposure	3. Sulfate Exposure	Similar
A.4 Corrosion Protection of Reinforcement	4. Corrosion Protection of Reinforcement	Similar
1905A - Concrete Quality, Mixing and Placing	**1905A - Concrete Quality, Mixing and Placing**	Similar
A.0 Notations	-	No effect
A.1 General (OSHPD amends to prescribe minimum strength	1. General	Evaluate OSHPD amendments for continuation
A.2 Selection of Concrete Proportions OSHPD amends to prescribe methods A, B, C for mix proportioning	2. Selection of Concrete Properties	Similar Evaluate OSHPD amendments for continuation (mix design A, B, C)
A.3 Proportioning on the Basis of Field Experience (Method B) and Trial Mixtures (Method C)	3. Proportioning on the Basis of Field Experience	Similar
A.4 Proportioning without Field Experience or Trial Mixtures.	4. Proportioning without Field Experience or Trial Mixtures	Similar
A.5 Average Strength Reduction.	5. Average Strength Reduction	Similar
A.6 Evaluation and Acceptance of Concrete (OSHPD amend: sampling) 1. Frequency of testing 2. Laboratory-cured specimens. 2.1 Samples for strength 2.2 Cylinders for strength 3. Field-cured specimens 4. Investigation of low-strength test results	6. Evaluation and Acceptance of Concrete	Similar Evaluate continuation of OSHPD amendments
A.7 Preparation of Equipment and Place of Deposit	7. Preparation of Equipment and Place of Deposit	Similar

Chapter 19A - Concrete

2001 CBC – Chapter 19A	IBC – Chapter 19	Comments
A.8 Mixing	8. Mixing	Similar
A.9 Conveying	9. Conveying	Similar
A.10 Depositing OSHPD amendment: A10.9, A10.10	10. Depositing	Similar Continue OSHPD amendments
A.11 Curing	11. Curing	Similar
A.12 Cold Weather Requirements OSHPD amendment A12.4	12. Cold Weather Requirements	Similar Continue OSHPD amendment
A.13 Hot Weather Requirements	13. Hot Weather Requirements	Similar
1906A - Formwork, Embedded Pipes and Construction Joints	**1906 - Formwork, Embedded Pipes and Construction Joints**	Similar
A.1 Design of Formwork	1. Formwork	Similar
A.2 Removal of Forms, Shores and Reshoring. 1. Removal of forms. OSHPD amends re: 12 hours min. 2. Removal of shores and reshoring	2. Removal of Forms, Shores and Reshoring	Similar Continue OSHPD amendments
A.3 Conduits and Pipes Embedded in Concrete. OSHPD amends - detailing openings	3. Conduits and Pipes Embedded in Concrete	Similar Continue OSHPD amendment
A.4 Construction Joints. OSHPD amends re: detailing and surface preparation	4. Construction Joints	Similar Continue OSHPD amendment
1907A - Details of Reinforcement	**1907 - Details of Reinforcement**	Similar
A.0 Notations	-	No effect
A.1 Standard Hooks	1. Hooks	Similar, except IBC refers to ACI 318-02 Sec. 7.1 and 7.2 for hook dimensions
A.2 Minimum Bend Diameters	2. Minimum Bend Diameters	Similar
A.3 Bending	3. Bending	Similar
A.4 Surface Conditions of Reinforcement	4. Surface Conditions of Reinforcement	Similar
A.5 Placing Reinforcement OSHPD amends re: PT tendons	5. Placing Reinforcement	Similar Continue OSHPD amendment
A.6 Spacing Limits for Reinforcement	6. Spacing Limits for Reinforcement	Similar
A.7 Concrete Protection for Reinforcement 1. Cast-in-place concrete (nonprestressed)	7. Concrete Protection for Reinforcement	Similar, except IBC refers to ACI 318-02 Section 7.7.3 for precast and prestress concrete Evaluate OSHPD amendments for continuation in IBC

2001 CBC – Chapter 19A	IBC – Chapter 19	Comments
OSHPD amends re: cover for tilt-up panel reinforcement 2. Precast concrete (manufactured under plant control conditions) 3. Prestressed concrete		
A.8 Special Reinforcement Details for Columns	8. Special Reinforcement Details for Columns	Similar
A.9 Connections	9. Connections	Similar, except IBC refers to ACI 318-02 Sec. 7.10
A.10 Lateral Reinforcement for Compression Members	10. Lateral Reinforcement for Compression Members	Similar
A.11 Lateral Reinforcement for Flexural Members	11. Lateral Reinforcement for Flexural Members	Similar, except IBC refers to ACI 318-02 Sec. 7.11
A.12 Shrinkage and Temperature Reinforcement	12. Shrinkage and Temperature Reinforcement	Similar, except IBC refers to ACI 318-02 Sec. 7.12
A.13 Requirements for Structural Integrity	13. Requirements for Structural Integrity	Similar, except IBC refers to ACI 318-02 Sec. 7.13
-	**1908 – Modifications to ACI 318**	IBC Section is new, and contains amendments to ACI 318, numbered 1908.1.1 through 1908.1.7 (all items pertain to ACI 318 Chapter 21 seismic provisions)
1908A – Analysis and Design	**Chapter 8 (ACI 318-02)** **Analysis and Design – General Considerations**	Design provisions contained (by reference per Section 1901) in Chapter 8 of ACI 318-02
A.0 Notations	8.0 Notations	Similar
A.1 Design Methods	8.1 Design Methods	Similar
A.2 Loading	8.2 Loading	Similar
A.3 Methods of Analysis	8.3 Methods of Analysis	Similar
A.4 Redistribution of Negative Moments in Continuous Nonprestressed Flexural Members	8.4 Redistribution of Negative Moments in Continuous Nonprestressed Flexural Members	Similar
A.5 Modulus of Elasticity	8.5 Modulus of Elasticity	Similar
A.6 Stiffness	8.6 Stiffness	Similar
A.7 Span Length	8.7 Span Length	Similar
A.8 Columns	8.8 Columns	Similar
A.9 Arrangement of Live Load	8.9 Arrangement of Live Load	Similar
A.10 T-beam Construction	8.10 T-beam Constuction	Similar
A.11 Concrete Joist Floor Construction (OSHPD amends)	8.11 Concrete Joist Floor Construction	Similar Continue OSHPD amendment in IBC 1908
A.12 Separate Floor Finish	8.12 Separate Floor Finish	Similar
1909A - Strength and Serviceability Requirements	**Chapter 9 (ACI 318-02)** **Strength and Serviceability Requirements**	Design provisions contained (by reference per Section 1901) in Chapter 9 of ACI 318-02

Chapter 19A - Concrete

2001 CBC – Chapter 19A	IBC – Chapter 19	Comments
A.0 Notations	9.0 Notation	Similar
A.1 General	9.1 General	Similar
A.2 Required Strength	9.2 Required Strength	Similar
A.3 Design Strength	9.3 Design Strength	Similar
A.4 Design Strength for Reinforcement	9.4 Design Strength for Reinforcement	Similar
A.5 Control of Deflections 1. general 2. one-way construction 3. two-way construction (non-prestress) 4. prestressed construction 5. composite construction; shored and unshored	9.5 Control of Deflections	Similar
1910A – Flexure and Axial Loads	**Chapter 10 (ACI 318-02)** **Flexure and Axial Loads**	Design provisions contained (by reference per Section 1901) in Chapter 10 of ACI 318-02
A.0 Notations	10.1 Notation	Similar
A.1 Scope	10.1 Scope	Similar
A.2 Design Assumptions	10.2 Design Assumptions	Similar
A.3 General Principles and Requirements	10.3 General Principals and Requirements	Similar
A.4 Distance between Lateral Supports of Flexural Members	10.4 Distance between Lateral Supports of Flexural Members	Similar
A.5 Minimum Reinforcement of Flexural Members	10.5 Minimum Reinforcement of Flexural Members	Similar
A.6 Distribution of Flexural Reinforcement in Beams and One-way Slabs	10.6 Distribution of Flexural Reinforcement in Beams and One-way Slabs	Similar
A.7 Deep Flexural Members	10.7 Deep Beams	Similar
A.8 Design Dimensions for Compression Members	10.8 Design Dimensions for Compression Members	Similar
A.9 Limits for Reinforcement of Compression Members	10.9 Limits for Reinforcement of Compression Members	Similar
A.10 Slenderness Effects in Compression Members	10.10 Slenderness Effects in Compression Members	Similar
A.11 Magnified Moments General	10.11 Magnified Moments - General	Similar
A.12 Magnified Moments Nonsway Frames	10.12 Magnified Moments Nonsway Frames	Similar
A.13 Magnified Moments Sway Frames	10.13 Magnified Moments Sway Frames	Similar
A.14 Axially Loaded Members Supporting Slab System	10.14 Axially Loaded Members Supporting Slab System	Similar
A.15 Transmission of Column	10.15 Transmission of Column	Similar

2001 CBC – Chapter 19A	IBC – Chapter 19	Comments
Loads through Floor System	Loads through Floor System	
A.16 Composite Compression Members	10.16 Composite Compression Members	Similar
A.17 Bearing Strength	10.17 Bearing Strength	Similar
1911A - Shear and Torsion	**Chapter 11 (ACI 318-02)** **Shear and Torsion**	Design provisions contained (by reference per Section 1901) in Chapter 11 of ACI 318-02
A.0 Notations	11.0 Notation	Similar
A.1 Shear Strength	11.1 Shear Strength	Similar
A.2 Lightweight Concrete	11.2 Lightweight Concrete	Similar
A.3 Shear Strength Provided by Concrete for Nonprestressed Members	11.3 Shear Strength Provided by Concrete for Nonprestressed Members	Similar
A.4 Shear Strength Provided by Concrete for Prestressed Members	11.4 Shear Strength Provided by Concrete for Prestressed Members	Similar
A.5 Shear Strength Provided by Shear Reinforcement	11.5 Shear Strength Provided by Shear Reinforcement	Similar
A.6 Design for Torsion	11.6 Design for Torsion	Similar
A.7 Shear-friction	11.7 Shear-friction	Similar
A.8 Special Provisions for Deep Flexural Members	11.8 Deep Beams	Similar
A.9 Special Provisions for Brackets and Corbels	11.9 Special Provisions for Brackets and Corbels	Similar
A.10 Special Provisions for Walls	11.10 Special Provisions for Walls	Similar
A.11 Transfer of Moments to Columns	11.11 Transfer of Moments to Columns	Similar
A.12 Special Provisions for Slabs and Footings	11.12 Special Provisions for Slabs and Footings	Similar
1912A – Development and Splices of Reinforcement	**Chapter 12 (ACI 318-02)** **Development and Splices of Reinforcement**	Design provisions contained (by reference per Section 1901) in Chapter 12 of ACI 318-02
A.0 Notations	12.0 Notation	Similar
A.1 Development of Reinforcement.General	12.1 Development of Reinforcement.General	Similar
A.2 Development of Deformed Bars and Deformed Wire in Tension	12.2 Development of Deformed Bars and Deformed Wire in Tension	Similar
A.3 Development of Deformed Bars in Compression	12.3 Development of Deformed Bars in Compression	Similar
A.4 Development of Bundled Bars	12.4 Development of Bundled Bars	Similar
A.5 Development of Standard Hooks in Tension	12.5 Development of Standard Hooks in Tension	Similar
A.6 Mechanical Anchorage	12.6 Mechanical Anchorage	Similar

2001 CBC – Chapter 19A	IBC – Chapter 19	Comments
A.7 Development of Welded Deformed Wire Fabric in Tension	12.7 Development of Welded Deformed Wire Fabric in Tension	Similar
A.8 Development of Welded Plain Wire Fabric in Tension	12.8 Development of Welded Plain Wire Fabric in Tension	Similar
A.9 Development of Prestressing Strand	12.9 Development of Prestressing Strand	Similar
A.10 Development of Flexural Reinforcement.	12.10 Development of Flexural Reinforcement	Similar
A.11 Development of Positive Moment Reinforcement	12.11 Development of Positive Moment Reinforcement	Similar
A.12 Development of Negative Moment Reinforcement.	12.12 Development of Negative Moment Reinforcement	Similar
A.13 Development of Web Reinforcement	12.13 Development of Web Reinforcement	Similar
A.14 Splices of Reinforcement	12.14 Splices of Reinforcement	Similar
A.15 Splices of Deformed Bars and Deformed Wire in Tension	12.15 Splices of Deformed Bars and Deformed Wire in Tension	Similar
A.16 Splices of Deformed Bars in Compression	12.16 Splices of Deformed Bars in Compression	Similar
A.17 Special Splice Requirements for Columns	12.17 Special Splice Requirements for Columns	Similar
A.18 Splices of Welded Deformed Wire Fabric in Tension	12.18 Splices of Welded Deformed Wire Fabric in Tension	Similar
A.19 Splices of Welded Plain Wire Fabric in Tension	12.19 Splices of Welded Plain Wire Fabric in Tension	Similar
1913A - Two-Way Slab Systems	**Chapter 13 (ACI 318-02)** **Two-Way Slab Systems**	Design provisions contained (by reference per Section 1901) in Chapter 13 of ACI 318-02
A.0 Notations	13.0 Notation	Similar
A.1 Scope	13.1 Scope	Similar
A.2 Definitions	13.2 Definitions	Similar
A.3 Slab Reinforcement	13.3 Slab Reinforcement	Similar
A.4 Openings in Slab Systems	13.4 Openings in Slab Systems	Similar
A.5 Design Procedures	13.5 Design Procedures	Similar
A.6 Direct Design Method	13.6 Direct Design Method	Similar
A.7 Equivalent Frame Method	13.7 Equivalent Frame Method	Similar
1914A – Walls	**Chapter 14 (ACI 318-02)** **Walls**	Design provisions contained (by reference per Section 1901) in Chapter 14 of ACI 318-02
A.0 Notations	14.0 Notation	Similar
A.1 Scope	14.1 Scope	Similar
A.2 General (OSHPD amends A.2.6)	14.2 General	Similar; continue OSHPD amendment in IBC 1914
A.3 Minimum Reinforcement	14.3 Minimum Reinforcement	Similar

2001 CBC – Chapter 19A	IBC – Chapter 19	Comments
A.4 Walls Designed as Compression Members	14.4 Walls Designed as Compression Members	Similar
-	14.5 Empirical Design Method	Evaluate for Non-adoption by OSHPD
A.6 Nonbearing Walls OSHPD amends	14.6 Nonbearing Walls	Similar; continue OSHPD amendment in IBC 1914
A.7 Walls as Grade Beams	14.7 Walls as Grade Beams	Similar
A.8 Alternate Design Slender Walls UBC amends ACI 318	14.8 Alternative Design of Slender Walls	Similar – evaluate for consistency with CBC provisions, if amendment needed place in IBC 1914
A.9 Wall Piers OSHPD amends	-	Continue OSHPD amendment in IBC 1914
A.10 Foundation Walls OSHPD amends	-	Continue OSHPD amendment (in IBC 1914), check terminology used in amendment for curb, wall, etc.
1915A – Footings	**Chapter 15 (ACI 318-02)** **Footings**	Design provisions contained (by reference per Section 1901) in Chapter 15 of ACI 318-02
A.0 Notations	15.0 Notation	Similar
A.1 Scope	15.1 Scope	Similar
A.2 Loads and Reactions OSHPD amends – A.2.1	15.2 Loads and Reactions	Similar; continue OSHPD amendment in IBC 1915
A.3 Footings Supporting Circular or Regular Polygon shaped Columns or Pedestals	15.3 Footings Supporting Circular or Regular Polygon shaped Columns or Pedestals	Similar
A.4 Moment in Footings	15.4 Moment in Footings	Similar
A.5 Shear in Footings	15.5 Shear in Footings	Similar
A.6 Development of Reinforcement in Footings	15.6 Development of Reinforcement in Footings	Similar
A.7 Minimum Footing Depth	15.7 Minimum Footing Depth	Similar
A.8 Transfer of Force at Base of Column, Wall or Reinforced Pedestal	15.8 Transfer of Force at Base of Column, Wall or Reinforced Pedestal	Similar
A.9 Sloped or Stepped Footings	15.9 Sloped or Stepped Footings	Similar
A.10 Combined Footings and Mats	15.10 Combined Footings and Mats	Similar
A.11 Plain Concrete Pedestals and Footings - OSHPD does not adopt	-	No effect
1916A - Precast Concrete	**Chapter 16 (ACI 318-02)** **Precast Concrete**	Design provisions contained (by reference per Section 1901) in Chapter 16 of ACI 318-02
A.0 Notations	16.0 Notation	Similar
A.1 Scope	16.1 Scope	Similar
A.2 General	16.2 General	Similar
A.3 Distribution of Forces among Members	16.3 Distribution of Forces among Members	Similar Review location of 1916A.3.3 – relocate to 1916A.11and

Chapter 19A - Concrete

2001 CBC – Chapter 19A	IBC – Chapter 19	Comments
OSHPD amendment (1916A.3.3)		continue (or locate in IBC 1908)
A.4 Member Design	16.4 Member Design	Similar
A.5 Structural Integrity	16.5 Structural Integrity	Similar
A.6 Connection and Bearing Design	16.6 Connection and Bearing Design	Similar
A.7 Items Embedded after Concrete Placement Minor OSHPD amendments	16.7 Items Embedded after Concrete Placement	Similar Evaluate OSHPD amendments for continuation
A.8 Marking and Identification	16.8 Marking and Identification	Similar
A.9 Handling	16.9 Handling	Similar
A.10 Strength Evaluation of Precast Construction	16.10 Strength Evaluation of Precast Construction	Similar
A.11 Reinforcement (OSHPD amendments)	-	Review 1916A.11 for updating, references, clarity
A.12 On-site Cast Precast Wall Panels (OSHPD amendments)	-	Review 1916A.12 for updating, references, clarity
1917A - Composite Concrete Flexural Members	**Chapter 17 (ACI 318-02)** **Composite Concrete Flexural Members**	Design provisions contained (by reference per Section 1901) in Chapter 17 of ACI 318-02
A.0 Notations	17.0 Notation	Similar
A.1 Scope	17.1 Scope	Similar
A.2 General	17.2 General	Similar
A.3 Shoring	17.3 Shoring	Similar
A.4 Vertical Shear Strength	17.4 Vertical Shear Strength	Similar
A.5 Horizontal Shear Strength	17.5 Horizontal Shear Strength	Similar
A.6 Ties for Horizontal Shear	17.6 Ties for Horizontal Shear	Similar
1918A – Prestressed Concrete	**Chapter 18 (ACI 318-02)** **Prestressed Concrete**	Design provisions contained (by reference per Section 1901) in Chapter 18 of ACI 318-02
A.0 Notations	18.0 Notation	Similar
A.1 Scope	18.1 Scope	Simlar
A.2 General OSHPD amends (1918A.2.3, 2.4, 2.7)	18.2 General	Similar, review OSHPD amendments – refers to PCI Design Handbook, 5th edition.
A.3 Design Assumptions	18.3 Design Assumptions	Similar
A.4 Permissible Stresses in Concrete Flexural Members	18.4 Serviceability Requirements - - Flexural Members	Similar
A.5 Permissible Stress in Prestressing Tendons	18.5 Permissible Stress in Prestressing Tendons	Similar
A.6 Loss of Prestress OSHPD amendment 1918A.6.4	18.6 Loss of Prestress	Similar; review OSHPD amendment 1918A.6.4 for continuation in IBC 1908

Chapter 19A - Concrete

2001 CBC – Chapter 19A	IBC – Chapter 19	Comments
A.7 Flexural Strength	18.7 Flexural Strength	Similar
A.8 Limits for Reinforcement of Flexural Members	18.8 Limits for Reinforcement of Flexural Members	Similar
A.9 Minimum Bonded Reinforcement UBC amends ACI 318	18.9 Minimum Bonded Reinforcement	Similar, check UBC amendments and ACI 318-02 provisions
A.10 Statically Indeterminate Structures	18.10 Statically Indeterminate Structures	Similar
A.11 Compression Members. Combined Flexure and Axial Loads	18.11 Compression Members. Combined Flexure and Axial Loads	Similar
A.12 Slab Systems OSHPD amendment 1918A.12.7	18.12 Slab Systems	Review amendment for continuation in IBC 1908
A.13 Tendon Anchorage Zones	18.13 Post-tensioned Tendon Anchorage Zones 18.14 Design of Anchorage Zones for Monostrand or Singel 5/8" Diameter Bar Tendons 18.15 Design of Anchorage Zones for Multistrand Tendons	Similar
A.14 Corrosion Protection for Unbonded Prestressing Tendons	18.16 Corrosion Protection for Unbonded Tendons	Similar
A.15 Posttensioning Ducts	18.17 Posttensioning Ducts	Similar
A.16 Grout for Bonded Prestressing Tendons	18.18 Grout for Bonded Tendons	Similar
A.17 Protection for Prestressing Tendons	18.19 Protection for Prestressing Steel	Similar
A.18 Application and Measurement of Prestress Force.	18.20 Application and Measurement of Prestress Force	Similar
A.19 Posttensioning Anchorages and Couplers OSHPD amendment – 1918A.19.5	18.21 Posttensioning Anchorages and Couplers 18.22 External Posttensioning	Similar, review amendment for continuation in IBC 1908
A.20 Lift Slab Shear OSHPD amendment	-	Review amendment for continuation in IBC 1908
A.21 Prestressed Flat Stab OSHPD amendment	-	Review amendment for continuation in IBC 1908
1919A - Shells and Folded Plates	**Chapter 19 (ACI 318-02)** **Shells and Folded Plate Members**	Design provisions contained (by reference per Section 1901) in Chapter 19 of ACI 318-02
A.0 Notations	19.0 Notation	Similar
A.1 Scope and Definitions	19.1 Scope and Definitions	Similar
A.2 Analysis and Design	19.2 Analysis and Design	Similar
A.3 Design Strength of Materials	19.3 Design Strength of Materials	Similar

Chapter 19A - Concrete

2001 CBC – Chapter 19A	IBC – Chapter 19	Comments
A.4 Shell Reinforcement	19.4 Shell Reinforcement	Similar
A.5 Construction	19.5 Construction	Similar
1920A – Strength Evaluation of Existing Structures	**Chapter 20 (ACI 318-02)** **Strength Evaluation of Existing Structures**	Design provisions contained (by reference per Section 1901) in Chapter 20 of ACI 318-02
A.0 Notations	20.0 Notation	Similar
A.1 Strength Evaluation General	20.1 Strength Evaluation General	Similar
A.2 Determination of Required Dimensions and Material Properties	20.2 Determination of Required Dimensions and Material Properties	Similar
A.3 Load Test Procedure	20.3 Load Test Procedure	Similar
A.4 Loading Criteria	20.4 Loading Criteria	Similar
A.5 Acceptance Criteria	20.5 Acceptance Criteria	Similar
A.6 Provisions for Lower Load Rating	20.6 Provisions for Lower Load Rating	Similar
A.7 Safety	20.7 Safety	Similar
1921A - Reinforced Concrete Structures Resisting Forces Induced by Earthquake Motions Note: model code amends ACI 318 provisions, OSHPD makes some minor amendments	**Chapter 21 (ACI 318-02) - Special Provisions for Seismic Design** **IBC Section 1910 Seismic Design Provisions** **IBC Section 1908 amends ACI 318, Ch. 21**	Design provisions contained (by reference per Section 1901) in Chapter 21 of ACI 318-02 User must consider all three sets of provisions (ACI Ch 21, IBC 1908 amendments to ACI, and IBC 1910, appears to be a somewhat complicated format Evaluate IBC provisions, ACI 318 Ch 21, and ASCE 7-02 for conflicts
A.0 Notations	21.0 Notation	Similar
A.1 Definitions	21.1 Definitions	Similar
A.2 General Requirements	21.2 General Requirements	Similar
A.3 Flexural Members of Frames.	21.3 Flexural Members of Special Moment Frames	Similar
A.4 Frame Members Subjected to Bending and Axial Load	21.4 Special Moment Frame Members Subjected to Bending and Axial Load	Similar
A.5 Joints of Frames	21.5 Joints of Special Moment Frames	Similar
-	21.6 Special Moment Frames Constructed Using Precast Concrete	Evaluate for adoption
A.6 Shear Walls, Diaphragms and Trusses	21.7 Special Reinforced Concrete Structural Walls & Coupling Beams 21.9 Special Diaphragms and Trusses	Similar
-	21.8 Special Structural Walls Constructed Using Precast Concrete	Evaluate for adoption
A.7 Frame Members Not Part of	21.11 Frame Members not	Similar

2001 CBC – Chapter 19A	IBC – Chapter 19	Comments
the Lateral-force-resisting System	Proportioned to Resist Forces Induced by Earthquake Motions	
-	21.10 Foundations	Check IBC Ch 18 provisions for any potential conflicts
-	21.12 Requirements for Intermediate Moment Frames	Evaluate for non-adoption
-	21.13 Intermediate Precast Structural Walls	Evaluate for non-adoption
1922A - Plain Concrete A.1 OSHPD amendment prohibiting plain concrete for use other than fill	**1909 Structural Plain Concrete** **Chapter 22 (ACI 318-02) – Structural Plain Concrete**	Evaluate IBC Sec. 1909 and ACI 318-02 Ch 22 provisions for non-adoption
Division III – Design Standard for Anchorage to Concrete **1923A - Anchorage to Concrete**	**1912 Anchorage to Concrete – Allowable Stress Design** **1913 Anchorage to Concrete – Strength Design**	Similar, 1913 refers to ACI 318-02 Appendix D provisions
A.1 Service Load Design	1912.1, 1912.2, 1912.3, 1912.4	Similar
A.2 Strength Design A.3 Strength of Anchors 1923A.3.1.1 [For OSHPD/SS] A.3.2 Design strength in tension A.3.3 Design strength in shear A.3.4 Combined tension and shear A.3.5 Drilled-in expansion bolts or chemical-type anchors in concrete. (OSHPD amendment)	1913.1 (refers to ACI 318 App D)	Similar, 318 Appendix D more comprehensive Evaluate OSHPD amendment for continuation
Division IV – Design and Construction Standard for Shotcrete **1924A – Shotcrete**	**1914 – Shotcrete**	Similar
A.1 General - OSHPD amends	1. General	Similar, continue OSHPD amendment
A.2 Proportions and Materials	2. Proportions and Materials	Similar
A.3 Aggregate	3. Aggregate	Similar
A.4 Reinforcement	4. Reinforcement	Similar
A.5 Preconstruction Tests	5. Preconstruction Tests	Similar
A.6 Rebound.	6. Rebound	Similar
A.7 Joints – OSHPD amends	7. Joints	Similar, continue OSHPD amendment
A.8 Damage	8. Damage	Similar
A.9 Curing	9. Curing	Similar
A.10 Strength Test - OSHPD amends	10. Strength Tests	Similar, continue OSHPD amendment
A.11 Inspections - OSHPD	-	Evaluate for continuation of CBC provisions as OSHPD

2001 CBC – Chapter 19A	IBC – Chapter 19	Comments
amends.		amendment
A.12 Equipment	-	Evaluate for continuation of CBC provisions as OSHPD amendment
A.13 Forms and Ground Wires for Shotcrete – OSHPD amends	-	Evaluate for continuation of CBC provisions as OSHPD amendment
A.14 Placing - OSHPD amends, refers to ACI 506 standard	-	Evaluate for continuation of CBC provisions as OSHPD amendment
Division V – Design Standard for Reinforced Gypsum Concrete **1925A – Reinforced Gypsum Concrete**	**1915 – Reinforced Gypsum Concrete**	IBC provisions primarily based on reference standards ASTM C 317 and C 956
A.1 General	ASTM C 317, C 956	Review referenced standard
A.2 Design	ASTM C 317, C 956	Review referenced standard
A.3 Stresses	ASTM C 317, C 956	Review referenced standard
A.4 Diaphragms OSHPD amends	ASTM C 317, C 856 1915.2 Minimum Thickness	Evaluate referenced standards and IBC provisions to determine location for OSHPD amendments
A.5 Details of Construction OSHPD amends	ASTM C 317, C 956	Evaluate referenced standards and IBC provision to determine location for OSHPD amendment
-	**1916 – Concrete-filled Pipe Columns**	Evaluate for adoption (or non-adoption)
Division VI – Alternate Design Method **1926A – Alternate Design Method** (WSD or ASD)	-	IBC does not contain Working Stress Design (WSD) or Allowable Stress Design (ASD) provisions, and ACI 318-02 Commentary Section R1.1 refers user to ACI 318-99 Appendix A. Evaluate need to adopt of Appendix A, ACI 318-99; if not adopted, allowance by OSHPD of ASD provisions will be discretionary
Division VII - Unified Design Provisions **1927A - Unified Design Provisions for Reinforced and Prestressed Concrete Flexural and Compression Members** see footnotes are bottom of page 2-184.83 (CBC, 2001 ed.)	**Appendix B (ACI 318-02)** **Alternate Provisions for Reinforced and Prestressed Concrete Flexural and Compression Members**	Similar, provisions contained in referenced standard (ACI 318-02)
Division VIII - Alternative Load-Factor Combination and Strength Reduction Factors **1928A – Alternative Load-Factor Combination and Strength Reduction Factors**	**Appendix C (ACI 318-02)** **Alternate Load and Strength Reduction Factors**	Similar, provisions contained in referenced standard (ACI 318-02)
1929A – Testing and Inspection Entire section is OSHPD amendment	-	Evaluate and continue OSHPD amendments, may be placed within Chapter 17

Chapter 19A - Concrete

2001 CBC – Chapter 19A	IBC – Chapter 19	Comments
A.1 Cementitious Material Test	-	Evaluate and continue OSHPD amendments, may be placed within Chapter 17
A.2 Tests of Reinforcing Bars	-	Evaluate and continue OSHPD amendments, may be placed within Chapter 17
A.3 Tests for Prestressing Steel and Anchorage	-	Evaluate and continue OSHPD amendments, may be placed within Chapter 17
A.4 Batch Plant Inspection	-	Evaluate and continue OSHPD amendments, may be placed within Chapter 17
A.5 Waiver of Batch Plant Inspection	-	Evaluate and continue OSHPD amendments, may be placed within Chapter 17
A.6 Waiver of Material Testing	-	Evaluate and continue OSHPD amendments, may be placed within Chapter 17
A.7 Placing Record	-	Evaluate and continue OSHPD amendments, may be placed within Chapter 17
A.8 Composite Construction Cores	-	Evaluate and continue OSHPD amendments, may be placed within Chapter 17
A.9 Inspection of Prestressed Concrete	-	Evaluate and continue OSHPD amendments, may be placed within Chapter 17
A.10 Inspection of Pneumatically Placed Concrete Work (Shotcrete)	-	Evaluate and continue OSHPD amendments, may be placed within Chapter 17
A.11 Tests of Shotcrete.	-	Evaluate and continue OSHPD amendments, may be placed within Chapter 17
A.12 Inspection of Welded Reinforcing Bars	-	Evaluate and continue OSHPD amendments, may be placed within Chapter 17
A.13 Gypsum Field Tests	-	Evaluate and continue OSHPD amendments, may be placed within Chapter 17
1930A – Existing Concrete Structures (OSHPD amendment)	-	Evaluate and continue OSHPD amendment, may be located in either Chapter 17 or 19
Table 19A-A-1 Total Air Content for Frost-Resistant Concrete	**Table 1904.2.1** Total Air Content for Frost-Resistant Concrete	Similar
Table 19A-A-2 Requirements for Special Exposure Conditions	**Table 1904.2.2(1)** Requirements for Special Exposure Conditions	Similar
-	**Figure 1904.2.2** Weathering Probability Map for Concrete	Evaluate
Table 19A-A-3 Requirements for Concrete Exposed to De-icing Chemicals	**Table 1904.2.3** Requirements for Concrete Exposed to De-icing Chemicals	Similar
Table 19A-A-4 Requirements for Concrete Exposed to Sulfate-Containing Solutions	**Table 1904.3** Requirements for Concrete Exposed to Sulfate-Containing Solutions	Similar

2001 CBC – Chapter 19A	IBC – Chapter 19	Comments
Table 19A-A-5 Maximum Chloride Ion Content for Corrosion Protection Reinforcement	**Table 1904.4.1** Maximum Chloride Ion Content for Corrosion Protection Reinforcement	Similar
Table 19A-A-6 Modification Factor for Standard Deviation When Less than 30 Tests are Available	**Table 5.3.1.2 (ACI 318-02)** Modification Factor for Standard Deviation When Less than 30 Tests are Available	Similar, table contained in ACI 318-02
Table 19A-A-7 Required Average Compressive Strength When Data are not Available to Establish a Standard Deviation	**Table 5.3.2.2 (ACI 318-02)** Required Average Compressive Strength When Data are not Available to Establish a Standard Deviation	Similar, table contained in ACI 318-02
Table 19A-A-8 (OSHPD amendment) Concrete Mixes by Limiting Proportions	-	Evaluate for continuation (prescriptive method A mix), seems useful for small projects
Table 19A-B Minimum Diameters of Bend	**Table 7.2 (ACI 318-02)** Minimum Diameters of Bend	Similar, table contained in ACI 318-02
Table 19A-C-1 Minimum Thickness of Nonprestressed Beams or One-Way Slabs Unless Deflections are Computed	**Table 9.5 (a) (ACI 318-02)** Minimum Thickness of Nonprestressed Beams or One-Way Slabs Unless Deflections are Computed	Similar, table contained in ACI 318-02
Table 19A-C-2 Maximum Permissible Computed Deflections	**Table 9.5 (b) (ACI 318-02)** Maximum Permissible Computed Deflections	Similar, table contained in ACI 318-02
Table 19A-C-3 Minimum Thickness of Slabs Without Interior Beams	**Table 9.5 (c) (ACI 318-02)** Minimum Thickness of Slabs Without Interior Beams	Similar, table contained in ACI 318-02
Table 19A-D Allowable Service Load on Embedded Bolts (OSHPD amends)	**Table 1912.2 (IBC)**	Similar, continue OSHPD amendments to CBC table
Table 19A-E Minimum Compressive Strength and Modulus of Elasticity and of Rigidity of Reinforced Gypsum Concrete	-	Review ASTM C 317, C 956 for equivalent provisions
Table 19A-F Allowable Unit Working Stress Reinforced Gypsum Concrete	-	Review ASTM C 317, C 956 for equivalent provisions
Table 19A-G Shear on Anchor Bolts and Dowels - Reinforced Gypsum Concrete	-	Review ASTM C 317, C 956 for equivalent provisions

2001 CBC – Chapter 19A	IBC – Chapter 19	Comments
Figure 19A-1 Minimum Extensions for Reinforcement in Slabs Without Beams	**Figure 13.3.8 (ACI 318-02)** Minimum Extensions for Reinforcement in Slabs Without Beams	Similar, Figure contained in ACI 318-02

Chapter 19A - Concrete

2001 CBC – Chapter 19A	NFPA 5000 – Chapter 41	Comments
Division I - GENERAL **1900A General**	**41.1 Scope**	Similar
A.1 Scope	41.1 Scope	Similar
A.2 General Requirements	41.2 General	Similar
A.3 Design Methods 1. Strength design (load and resistance factor design 2. Allowable stress design	41.2 General	NFPA 5000 refers to ACI 318 (2002 edition per Chapter 2) for construction and design provisions
A.4 Additional Design and Construction Requirements 1. Anchorage 2. Shotcrete 3. Reinforced gypsum concrete 4. Minimum slab thickness 5. [Not adopted by OSHPD] Unified design provisions for reinforced and prestressed concrete flexural and compression members 6. [Not adopted by OSHPD] Alternative load-factor combination and strength-reduction	41.1.2 - CIP reinforced gypsum concrete 41.7 – Shotcrete 41.6 Slabs-on-Ground 41.6.3 Vapor Retarder (new)	No effect
Division II **1901A - Scope**	**41.1 Scope**	CBC adopts ACI 318-95 and transcribes into the model code, with changes from 318-95 denoted in italics NFPA 5000 adopts ACI 318-02 by reference, with no transcription of any provisions in to the body of NFPA 5000
1902A - Definitions	**Chapter 2 (ACI 318-02)** **Definitions**	Provisions contained in referenced standard
1903A – Specifications for Tests and Materials	**Chapter 3 (ACI 318-02)** **Standards for Tests and Materials**	Provisions contained in referenced standard
A.0 Notation	3.0 Notation	Similar
A.1 Tests of Materials	3.1 Tests of Materials	Similar
A.2 Cement	3.2 Cements	Similar
A.3 Aggregates OSHPD has substantial amendments pertaining to aggregates	3.3 Aggregates	Similar
A.4 Water.	3.4 Water	Similar
A.5 Steel Reinforcement. OSHPD amendment re: welding bars	3.5 Steel Reinforcement	Similar, evaluate OSHPD amendment for continuation

Chapter 19A - Concrete

2001 CBC – Chapter 19A	NFPA 5000 – Chapter 41	Comments
A.6 Admixtures OSHPD amendment re: fly ash	3.6 Admixtures	Similar, evaluate OSHPD amendments for continuation
A.7 Storage of Materials.	3.7 Storage of Materials	Similar
A.8 Concrete Testing.	5.6 (ACI 318), NFPA 5000 Sec. 41.4	Similar
A.9 Concrete Mix.	5.8 (ACI 318)	Similar
A.10 Welding	3.5.2	Similar
A.11 Glass Fiber Reinforced Concrete	-	OSHPD may need to adopt (by amendment) the PCI *MNL 128 Standard*
1904A – Durability Requirements	**Chapter 4 (ACI 318-02)** **Durability Requirements**	Provisions contained in referenced standard
A.0 Notation	4.0 Notation	Similar
A.1 Water-Cementitious Materials Ratio	4.1 Water-Cementitious Materials Ratio	Similar
A.2 Freezing and Thawing Exposures.	4.2 Freezing and Thawing Exposures	Similar
A.3 Sulfate Exposure	4.3 Sulfate Exposure	Similar
A.4 Corrosion Protection of Reinforcement	4.4 Corrosion Protection of Reinforcement	Similar
1905A - Concrete Quality, Mixing and Placing	**Chapter 5 (ACI 318-02)** **Concrete Quality, Mixing and Placing**	Provisions contained in referenced standard
A.0 Notations	5.0 Notation	Similar
A.1 General (OSHPD amends to prescribe minimum strength	5.1 General	Similar, OSHPD amendment to be continued in NFPA 5000
A.2 Selection of Concrete Proportions OSHPD amends to prescribe methods A, B, C for mix proportioning	5.2 Selection of Concrete Properties	Similar Evaluate OSHPD amendments for continuation (mix design A, B, C) in NFPA 5000
A.3 Proportioning on the Basis of Field Experience (Method B) and Trial Mixtures (Method C)	5.3 Proportioning on the Basis of Field Experience or Trial Mixtures, or Both	Similar
A.4 Proportioning without Field Experience or Trial Mixtures.	5.4 Proportioning without Field Experience or Trial Mixtures	Similar
A.5 Average Strength Reduction.	5.5 Average Strength Reduction	Similar
A.6 Evaluation and Acceptance of Concrete (OSHPD amend: sampling) 1. Frequency of testing 2. Laboratory-cured specimens. 2.1 Samples for strength 2.2 Cylinders for strength 3. Field-cured specimens 4. Investigation of low-strength	5.6 Evaluation and Acceptance of Concrete	Similar Evaluate continuation of OSHPD amendments in NFPA 5000

2001 CBC – Chapter 19A	NFPA 5000 – Chapter 41	Comments
test results		
A.7 Preparation of Equipment and Place of Deposit	5.7 Preparation of Equipment and Place of Deposit	Similar
A.8 Mixing	5.8 Mixing	Similar
A.9 Conveying	5.9 Conveying	Similar
A.10 Depositing OSHPD amendment: A10.9, A10.10	5.10 Depositing	Similar Continue OSHPD amendments in NFPA 5000
A.11 Curing	5.11 Curing	Similar
A.12 Cold Weather Requirements OSHPD amendment A12.4	5.12 Cold Weather Requirements	Similar Continue OSHPD amendment in NFPA 5000
A.13 Hot Weather Requirements	5.13 Hot Weather Requirements	Similar
1906A - Formwork, Embedded Pipes and Construction Joints	**Chapter 6 (ACI 318-02)** **Formwork, Embedded Pipes and Construction Joints**	Provisions contained in referenced standard
A.1 Design of Formwork	6.1 Design of Formwork	Similar
A.2 Removal of Forms, Shores and Reshoring. 1. Removal of forms. OSHPD amends re: 12 hours min. 2. Removal of shores and reshoring	6.2 Removal of Forms, Shores and Reshoring	Similar Continue OSHPD amendments in NFPA 5000
A.3 Conduits and Pipes Embedded in Concrete. OSHPD amends - detailing openings	6.3 Conduits and Pipes Embedded in Concrete	Similar Continue OSHPD amendment in NFPA 5000
A.4 Construction Joints. OSHPD amends re: detailing and surface preparation	6.4. Construction Joints	Similar Continue OSHPD amendment in NFPA 5000
1907A - Details of Reinforcement	**Chapter 7 (ACI 318-02)** **Details of Reinforcement**	Provisions contained in referenced standard
A.0 Notations	7.0 Notation	Similar
A.1 Standard Hooks	7.1 Standard Hooks	Similar
A.2 Minimum Bend Diameters	7.2 Minimum Bend Diameters	Similar
A.3 Bending	7.3 Bending	Similar
A.4 Surface Conditions of Reinforcement	7.4 Surface Conditions of Reinforcement	Similar
A.5 Placing Reinforcement OSHPD amends re: PT tendons	7.5 Placing Reinforcement	Similar Continue OSHPD amendment in NFPA 5000
A.6 Spacing Limits for Reinforcement	7.6 Spacing Limits for Reinforcement	Similar

Chapter 19A - Concrete

2001 CBC – Chapter 19A	NFPA 5000 – Chapter 41	Comments
A.7 Concrete Protection for Reinforcement 1. Cast-in-place concrete (nonprestressed) OSHPD amends re: cover for tilt-up panel reinforcement 2. Precast concrete (manufactured under plant control conditions) 3. Prestressed concrete	7.7 Concrete Protection for Reinforcement	Similar Evaluate OSHPD amendments for continuation in NFPA 5000
A.8 Special Reinforcement Details for Columns	7.8 Special Reinforcement Details for Columns	Similar
A.9 Connections	7.9 Connections	Similar
A.10 Lateral Reinforcement for Compression Members	7.10 Lateral Reinforcement for Compression Members	Similar
A.11 Lateral Reinforcement for Flexural Members	7.11 Lateral Reinforcement for Flexural Members	Similar
A.12 Shrinkage and Temperature Reinforcement	7.12 Shrinkage and Temperature Reinforcement	Similar
A.13 Requirements for Structural Integrity	7.13 Requirements for Structural Integrity	Similar
1908A – Analysis and Design	**Chapter 8 (ACI 318-02)** **Analysis and Design – General Considerations**	Design provisions contained (by reference per NFPA 5000 Section 41.2) in Chapter 8 of ACI 318-02
A.0 Notations	8.0 Notations	Similar
A.1 Design Methods	8.1 Design Methods	Similar
A.2 Loading	8.2 Loading	Similar
A.3 Methods of Analysis	8.3 Methods of Analysis	Similar
A.4 Redistribution of Negative Moments in Continuous Nonprestressed Flexural Members	8.4 Redistribution of Negative Moments in Continuous Nonprestressed Flexural Members	Similar
A.5 Modulus of Elasticity	8.5 Modulus of Elasticity	Similar
A.6 Stiffness	8.6 Stiffness	Similar
A.7 Span Length	8.7 Span Length	Similar
A.8 Columns	8.8 Columns	Similar
A.9 Arrangement of Live Load	8.9 Arrangement of Live Load	Similar
A.10 T-beam Construction	8.10 T-beam Constuction	Similar
A.11 Concrete Joist Floor Construction (OSHPD amends – A11.5, A11.6, A11.9)	8.11 Concrete Joist Floor Construction	Similar Continue OSHPD amendment (amend the referenced standard ACI 318-02 in NFPA 5000)
A.12 Separate Floor Finish	8.12 Separate Floor Finish	Similar
1909A - Strength and Serviceability Requirements	**Chapter 9 (ACI 318-02)**	Design provisions contained (by reference per NFPA 5000 Section 41.2) in Chapter 9 of ACI 318-02

2001 CBC – Chapter 19A	NFPA 5000 – Chapter 41	Comments
	Strength and Serviceability Requirements	
A.0 Notations	9.0 Notation	Similar
A.1 General	9.1 General	Similar
A.2 Required Strength	9.2 Required Strength	Similar
A.3 Design Strength	9.3 Design Strength	Similar
A.4 Design Strength for Reinforcement	9.4 Design Strength for Reinforcement	Similar
A.5 Control of Deflections 1. general 2. one-way construction 3. two-way construction (non-prestress) 4. prestressed construction 5. composite construction; shored and unshored	9.5 Control of Deflections	Similar
1910A – Flexure and Axial Loads	**Chapter 10 (ACI 318-02)** **Flexure and Axial Loads**	Design provisions contained (by reference per NFPA 5000 Section 41.2) in Chapter 10 of ACI 318-02
A.0 Notations	10.1 Notation	Similar
A.1 Scope	10.1 Scope	Similar
A.2 Design Assumptions	10.2 Design Assumptions	Similar
A.3 General Principles and Requirements	10.3 General Principals and Requirements	Similar
A.4 Distance between Lateral Supports of Flexural Members	10.4 Distance between Lateral Supports of Flexural Members	Similar
A.5 Minimum Reinforcement of Flexural Members	10.5 Minimum Reinforcement of Flexural Members	Similar
A.6 Distribution of Flexural Reinforcement in Beams and One-way Slabs	10.6 Distribution of Flexural Reinforcement in Beams and One-way Slabs	Similar
A.7 Deep Flexural Members	10.7 Deep Beams	Similar
A.8 Design Dimensions for Compression Members	10.8 Design Dimensions for Compression Members	Similar
A.9 Limits for Reinforcement of Compression Members	10.9 Limits for Reinforcement of Compression Members	Similar
A.10 Slenderness Effects in Compression Members	10.10 Slenderness Effects in Compression Members	Similar
A.11 Magnified Moments General	10.11 Magnified Moments - General	Similar
A.12 Magnified Moments Nonsway Frames	10.12 Magnified Moments Nonsway Frames	Similar
A.13 Magnified Moments Sway Frames	10.13 Magnified Moments Sway Frames	Similar
A.14 Axially Loaded Members	10.14 Axially Loaded Members	Similar

2001 CBC – Chapter 19A	NFPA 5000 – Chapter 41	Comments
Supporting Slab System	Supporting Slab System	
A.15 Transmission of Column Loads through Floor System	10.15 Transmission of Column Loads through Floor System	Similar
A.16 Composite Compression Members	10.16 Composite Compression Members	Similar
A.17 Bearing Strength	10.17 Bearing Strength	Similar
1911A - Shear and Torsion	**Chapter 11 (ACI 318-02)** **Shear and Torsion**	Design provisions contained (by reference per NFPA 5000 Section 41.2) in Chapter 11 of ACI 318-02
A.0 Notations	11.0 Notation	Similar
A.1 Shear Strength	11.1 Shear Strength	Similar
A.2 Lightweight Concrete	11.2 Lightweight Concrete	Similar
A.3 Shear Strength Provided by Concrete for Nonprestressed Members	11.3 Shear Strength Provided by Concrete for Nonprestressed Members	Similar
A.4 Shear Strength Provided by Concrete for Prestressed Members	11.4 Shear Strength Provided by Concrete for Prestressed Members	Similar
A.5 Shear Strength Provided by Shear Reinforcement	11.5 Shear Strength Provided by Shear Reinforcement	Similar
A.6 Design for Torsion	11.6 Design for Torsion	Similar
A.7 Shear-friction	11.7 Shear-friction	Similar
A.8 Special Provisions for Deep Flexural Members	11.8 Deep Beams	Similar
A.9 Special Provisions for Brackets and Corbels	11.9 Special Provisions for Brackets and Corbels	Similar
A.10 Special Provisions for Walls	11.10 Special Provisions for Walls	Similar
A.11 Transfer of Moments to Columns	11.11 Transfer of Moments to Columns	Similar
A.12 Special Provisions for Slabs and Footings	11.12 Special Provisions for Slabs and Footings	Similar
1912A – Development and Splices of Reinforcement	**Chapter 12 (ACI 318-02)** **Development and Splices of Reinforcement**	Design provisions contained (by reference per NFPA 5000 Section 41.2) in Chapter 12 of ACI 318-02
A.0 Notations	12.0 Notation	Similar
A.1 Development of Reinforcement.General	12.1 Development of Reinforcement.General	Similar
A.2 Development of Deformed Bars and Deformed Wire in Tension	12.2 Development of Deformed Bars and Deformed Wire in Tension	Similar
A.3 Development of Deformed Bars in Compression	12.3 Development of Deformed Bars in Compression	Similar
A.4 Development of Bundled Bars	12.4 Development of Bundled Bars	Similar
A.5 Development of Standard	12.5 Development of Standard	Similar

2001 CBC – Chapter 19A	NFPA 5000 – Chapter 41	Comments
Hooks in Tension	Hooks in Tension	
A.6 Mechanical Anchorage	12.6 Mechanical Anchorage	Similar
A.7 Development of Welded Deformed Wire Fabric in Tension	12.7 Development of Welded Deformed Wire Fabric in Tension	Similar
A.8 Development of Welded Plain Wire Fabric in Tension	12.8 Development of Welded Plain Wire Fabric in Tension	Similar
A.9 Development of Prestressing Strand	12.9 Development of Prestressing Strand	Similar
A.10 Development of Flexural Reinforcement.	12.10 Development of Flexural Reinforcement	Similar
A.11 Development of Positive Moment Reinforcement	12.11 Development of Positive Moment Reinforcement	Similar
A.12 Development of Negative Moment Reinforcement.	12.12 Development of Negative Moment Reinforcement	Similar
A.13 Development of Web Reinforcement	12.13 Development of Web Reinforcement	Similar
A.14 Splices of Reinforcement	12.14 Splices of Reinforcement	Similar
A.15 Splices of Deformed Bars and Deformed Wire in Tension	12.15 Splices of Deformed Bars and Deformed Wire in Tension	Similar
A.16 Splices of Deformed Bars in Compression	12.16 Splices of Deformed Bars in Compression	Similar
A.17 Special Splice Requirements for Columns	12.17 Special Splice Requirements for Columns	Similar
A.18 Splices of Welded Deformed Wire Fabric in Tension	12.18 Splices of Welded Deformed Wire Fabric in Tension	Similar
A.19 Splices of Welded Plain Wire Fabric in Tension	12.19 Splices of Welded Plain Wire Fabric in Tension	Similar
1913A - Two-Way Slab Systems	**Chapter 13 (ACI 318-02)** **Two-Way Slab Systems**	Design provisions contained (by reference per NFPA 5000 Section 41.2) in Chapter 13 of ACI 318-02
A.0 Notations	13.0 Notation	Similar
A.1 Scope	13.1 Scope	Similar
A.2 Definitions	13.2 Definitions	Similar
A.3 Slab Reinforcement	13.3 Slab Reinforcement	Similar
A.4 Openings in Slab Systems	13.4 Openings in Slab Systems	Similar
A.5 Design Procedures	13.5 Design Procedures	Similar
A.6 Direct Design Method	13.6 Direct Design Method	Similar
A.7 Equivalent Frame Method	13.7 Equivalent Frame Method	Similar
1914A – Walls	**Chapter 14 (ACI 318-02)** **Walls**	Design provisions contained (by reference per NFPA 5000 Section 41.2) in Chapter 14 of ACI 318-02
A.0 Notations	14.0 Notation	Similar
A.1 Scope	14.1 Scope	Similar
A.2 General (OSHPD amends	14.2 General	Similar; continue OSHPD amendment in NFPA 5000

2001 CBC – Chapter 19A	NFPA 5000 – Chapter 41	Comments
A.2.6)		
A.3 Minimum Reinforcement	14.3 Minimum Reinforcement	Similar
A.4 Walls Designed as Compression Members	14.4 Walls Designed as Compression Members	Similar
-	14.5 Empirical Design Method	Evaluate for Non-adoption by OSHPD
A.6 Nonbearing Walls OSHPD amends	14.6 Nonbearing Walls	Similar; continue OSHPD amendment in NFPA 5000
A.7 Walls as Grade Beams	14.7 Walls as Grade Beams	Similar
A.8 Alternate Design Slender Walls UBC amends ACI 318	14.8 Alternative Design of Slender Walls	Similar – evaluate for consistency with CBC provisions, if amendment needed place in NFPA 5000
A.9 Wall Piers OSHPD amends	-	Continue OSHPD amendment in NFPA 5000
A.10 Foundation Walls OSHPD amends	-	Continue OSHPD amendment (in NFPA 5000), check terminology used in amendment for curb, wall, etc.
1915A – Footings	**Chapter 15 (ACI 318-02)** **Footings**	Design provisions contained (by reference per NFPA 5000 Section 41.2) in Chapter 15 of ACI 318-02
A.0 Notations	15.0 Notation	Similar
A.1 Scope	15.1 Scope	Similar
A.2 Loads and Reactions OSHPD amends	15.2 Loads and Reactions	Similar; continue OSHPD amendment in NFPA 5000
A.3 Footings Supporting Circular or Regular Polygon shaped Columns or Pedestals	15.3 Footings Supporting Circular or Regular Polygon shaped Columns or Pedestals	Similar
A.4 Moment in Footings	15.4 Moment in Footings	Similar
A.5 Shear in Footings	15.5 Shear in Footings	Similar
A.6 Development of Reinforcement in Footings	15.6 Development of Reinforcement in Footings	Similar
A.7 Minimum Footing Depth	15.7 Minimum Footing Depth	Similar
A.8 Transfer of Force at Base of Column, Wall or Reinforced Pedestal	15.8 Transfer of Force at Base of Column, Wall or Reinforced Pedestal	Similar
A.9 Sloped or Stepped Footings	15.9 Sloped or Stepped Footings	Similar
A.10 Combined Footings and Mats	15.10 Combined Footings and Mats	Similar
A.11 Plain Concrete Pedestals and Footings - OSHPD does not adopt	-	No effect
1916A - Precast Concrete	**Chapter 16 (ACI 318-02)** **Precast Concrete**	Design provisions contained (by reference per NFPA 5000 Section 41.2) in Chapter 16 of ACI 318-02
A.0 Notations	16.0 Notation	Similar
A.1 Scope	16.1 Scope	Similar
A.2 General	16.2 General	Similar

Chapter 19A - Concrete

2001 CBC – Chapter 19A	NFPA 5000 – Chapter 41	Comments
A.3 Distribution of Forces among Members OSHPD amendment (1916A.3.3)	16.3 Distribution of Forces among Members	Similar Review location of 1916A.3.3 – relocate to 1916A.11and continue (locate in NFPA 5000)
A.4 Member Design	16.4 Member Design	Similar
A.5 Structural Integrity	16.5 Structural Integrity	Similar
A.6 Connection and Bearing Design	16.6 Connection and Bearing Design	Similar
A.7 Items Embedded after Concrete Placement Minor OSHPD amendments	16.7 Items Embedded after Concrete Placement	Similar Evaluate OSHPD amendments for continuation
A.8 Marking and Identification	16.8 Marking and Identification	Similar
A.9 Handling	16.9 Handling	Similar
A.10 Strength Evaluation of Precast Construction	16.10 Strength Evaluation of Precast Construction	Similar
A.11 Reinforcement (OSHPD amendments)	-	Review CBC 1916A.11 for updating, references, clarity
A.12 On-site Cast Precast Wall Panels (OSHPD amendments)	-	Review CBC 1916A.12 for updating, references, clarity
1917A - Composite Concrete Flexural Members	**Chapter 17 (ACI 318-02)** **Composite Concrete Flexural Members**	Design provisions contained (by reference per NFPA 5000 Section 41.2) in Chapter 17 of ACI 318-02
A.0 Notations	17.0 Notation	Similar
A.1 Scope	17.1 Scope	Similar
A.2 General	17.2 General	Similar
A.3 Shoring	17.3 Shoring	Similar
A.4 Vertical Shear Strength	17.4 Vertical Shear Strength	Similar
A.5 Horizontal Shear Strength	17.5 Horizontal Shear Strength	Similar
A.6 Ties for Horizontal Shear	17.6 Ties for Horizontal Shear	Similar
1918A – Prestressed Concrete	**Chapter 18 (ACI 318-02)** **Prestressed Concrete**	Design provisions contained (by reference per NFPA 5000 Section 41.2) in Chapter 18 of ACI 318-02
A.0 Notations	18.0 Notation	Similar
A.1 Scope	18.1 Scope	Simlar
A.2 General OSHPD Amends	18.2 General	Similar, review OSHPD amendments – refers to PCI Design Handbook, 5th edition.
A.3 Design Assumptions	18.3 Design Assumptions	Similar
A.4 Permissible Stresses in Concrete Flexural Members	18.4 Serviceability Requirements -- Flexural Members	Similar
A.5 Permissible Stress in Prestressing Tendons	18.5 Permissible Stress in Prestressing Tendons	Similar
A.6 Loss of Prestress	18.6 Loss of Prestress	Similar; review OSHPD amendment 1918A.6.4 for continuation in NFPA 5000

2001 CBC – Chapter 19A	NFPA 5000 – Chapter 41	Comments
OSHPD amendment 1918A.6.4		
A.7 Flexural Strength	18.7 Flexural Strength	Similar
A.8 Limits for Reinforcement of Flexural Members	18.8 Limits for Reinforcement of Flexural Members	Similar
A.9 Minimum Bonded Reinforcement UBC amends ACI 318	18.9 Minimum Bonded Reinforcement	Similar, check UBC amendments and ACI 318-02 provisions
A.10 Statically Indeterminate Structures	18.10 Statically Indeterminate Structures	Similar
A.11 Compression Members. Combined Flexure and Axial Loads	18.11 Compression Members. Combined Flexure and Axial Loads	Similar
A.12 Slab Systems OSHPD amendment 1918A.12.7	18.12 Slab Systems	Review amendment for continuation in NFPA 5000
A.13 Tendon Anchorage Zones	18.13 Post-tensioned Tendon Anchorage Zones 18.14 Design of Anchorage Zones for Monostrand or Singel 5/8" Diameter Bar Tendons 18.15 Design of Anchorage Zones for Multistrand Tendons	Similar
A.14 Corrosion Protection for Unbonded Prestressing Tendons	18.16 Corrosion Protection for Unbonded Tendons	Similar
A.15 Posttensioning Ducts	18.17 Posttensioning Ducts	Similar
A.16 Grout for Bonded Prestressing Tendons	18.18 Grout for Bonded Tendons	Similar
A.17 Protection for Prestressing Tendons	18.19 Protection for Prestressing Steel	Similar
A.18 Application and Measurement of Prestress Force.	18.20 Application and Measurement of Prestress Force	Similar
A.19 Posttensioning Anchorages and Couplers OSHPD amendment – 1918A.19.5	18.21 Posttensioning Anchorages and Couplers 18.22 External Posttensioning	Similar, review amendment for continuation in NFPA 5000
A.20 Lift Slab Shear OSHPD amendment	-	Review amendment for continuation in NFPA 5000
A.21 Prestressed Flat Stab OSHPD amendment	-	Review amendment for continuation in NFPA 5000
1919A - Shells and Folded Plates	**Chapter 19 (ACI 318-02)** **Shells and Folded Plate Members**	Design provisions contained (by reference per NFPA 5000 Section 41.2) in Chapter 19 of ACI 318-02
A.0 Notations	19.0 Notation	Similar
A.1 Scope and Definitions	19.1 Scope and Definitions	Similar
A.2 Analysis and Design	19.2 Analysis and Design	Similar

Chapter 19A - Concrete

2001 CBC – Chapter 19A	NFPA 5000 – Chapter 41	Comments
A.3 Design Strength of Materials	19.3 Design Strength of Materials	Similar
A.4 Shell Reinforcement	19.4 Shell Reinforcement	Similar
A.5 Construction	19.5 Construction	Similar
1920A – Strength Evaluation of Existing Structures	**Chapter 20 (ACI 318-02)** **Strength Evaluation of Existing Structures**	Design provisions contained (by reference per NFPA 5000 Section 41.2) in Chapter 20 of ACI 318-02
A.0 Notations	20.0 Notation	Similar
A.1 Strength Evaluation General	20.1 Strength Evaluation General	Similar
A.2 Determination of Required Dimensions and Material Properties	20.2 Determination of Required Dimensions and Material Properties	Similar
A.3 Load Test Procedure	20.3 Load Test Procedure	Similar
A.4 Loading Criteria	20.4 Loading Criteria	Similar
A.5 Acceptance Criteria	20.5 Acceptance Criteria	Similar
A.6 Provisions for Lower Load Rating	20.6 Provisions for Lower Load Rating	Similar
A.7 Safety	20.7 Safety	Similar
1921A - Reinforced Concrete Structures Resisting Forces Induced by Earthquake Motions Note: model code amends ACI 318 provisions, OSHPD makes some minor amendments	**Chapter 21 (ACI 318-02) - Special Provisions for Seismic Design** **NFPA 5000 Sec. 41.5** (references provisions of ASCE 7-02, Sec. A9.9)	Design provisions contained (by reference per NFPA 5000 Section 41.2) in Chapter 21 of ACI 318-02 Evaluate ACI 318 Ch 21, and ASCE 7-02 for conflicts (ACI 318-02 references ASCE 7-98)
A.0 Notations	21.0 Notation	Similar
A.1 Definitions	21.1 Definitions	Similar
A.2 General Requirements	21.2 General Requirements	Similar
A.3 Flexural Members of Frames.	21.3 Flexural Members of Special Moment Frames	Similar
A.4 Frame Members Subjected to Bending and Axial Load	21.4 Special Moment Frame Members Subjected to Bending and Axial Load	Similar
A.5 Joints of Frames	21.5 Joints of Special Moment Frames	Similar
-	21.6 Special Moment Frames Constructed Using Precast Concrete	Evaluate for adoption
A.6 Shear Walls, Diaphragms and Trusses	21.7 Special Reinforced Concrete Structural Walls & Coupling Beams 21.9 Special Diaphragms and Trusses	Similar
-	21.8 Special Structural Walls Constructed Using Precast Concrete	Evaluate for adoption

Chapter 19A - Concrete

2001 CBC – Chapter 19A	NFPA 5000 – Chapter 41	Comments
A.7 Frame Members Not Part of the Lateral-force-resisting System	21.11 Frame Members not Proportioned to Resist Forces Induced by Earthquake Motions	Similar
See 41.2.3.3	21.10 Foundations	Check 41.2.3.3 provisions for any potential conflicts and implementation issues
-	21.12 Requirements for Intermediate Moment Frames	Evaluate for non-adoption
-	21.13 Intermediate Precast Structural Walls	Evaluate for non-adoption
1922A - Plain Concrete A.1 OSHPD amendment prohibiting plain concrete for use other than fill	**Chapter 22 (ACI 318-02) – Structural Plain Concrete**	Evaluate ACI 318-02 Ch 22 provisions for non-adoption
Division III – Design Standard for Anchorage to Concrete **1923A - Anchorage to Concrete**	**Appendix D (ACI 318-02)**	Referenced standard ACI 318-02 Appendix D provisions apply, no tabulated values as currently provided App. D provisions are both new to ACI 318 and are relatively complex (compared with CBC provisions)
A.1 Service Load Design	-	None provided – presents useability/training issues for staff and consitutents (no ASD table as in CBC)
A.2 Strength Design A.3 Strength of Anchors 1923A.3.1.1 [For OSHPD/SS] A.3.2 Design strength in tension A.3.3 Design strength in shear A.3.4 Combined tension and shear A.3.5 Drilled-in expansion bolts or chemical-type anchors in concrete. (OSHPD amendment)	See Appendix D, ACI 318-02	Similar, Appendix D of ACI 318-02 more comprehensive Evaluate OSHPD amendments for continuation
Division IV – Design and Construction Standard for Shotcrete **1924A – Shotcrete**	**41.7 Shotcrete** 41.7.2 adopts ACI 506.2, *Specification for Materials, Proportioning, and Application of Shotcrete*	Evaluate ACI 506.2 and OSHPD amendments to determine whether or not to continue amendments, and that ACI 506.2 addresses aspects of design, construction and testing as the CBC currently does.
A.1 General - OSHPD amends		
A.2 Proportions and Materials		
A.3 Aggregate		
A.4 Reinforcement		
A.5 Preconstruction Tests		
A.6 Rebound.		
A.7 Joints – OSHPD amends		
A.8 Damage		
A.9 Curing		

2001 CBC – Chapter 19A	NFPA 5000 – Chapter 41	Comments
A.10 Strength Test - OSHPD amends		
A.11 Inspections - OSHPD amends.		
A.12 Equipment		
A.13 Forms and Ground Wires for Shotcrete – OSHPD amends		
A.14 Placing - OSHPD amends, refers to ACI 506 standard		
Division V – Design Standard for Reinforced Gypsum Concrete **1925A – Reinforced Gypsum Concrete**	**41.8 Reinforced Gypsum Concrete**	NFPA 5000 provisions primarily based on reference standards: ASTM C 317, *Standard Specification for Gypsum Concrete* ASTM C 956, *Standard Specification for Installation of Cast-in-Place Reinforced Gypsum Concrete* ASTM C 472, *Standard Test Methods…*
A.1 General	ASTM C 317, C 956	Review referenced standard
A.2 Design	ASTM C 317, C 956	Review referenced standard
A.3 Stresses	ASTM C 317, C 956	Review referenced standard
A.4 Diaphragms OSHPD amends	ASTM C 317, C 856 1915.2 Minimum Thickness	Evaluate referenced standards to determine need to continue OSHPD amendments
A.5 Details of Construction OSHPD amends	ASTM C 317, C 956	Evaluate referenced standards to determine need to continue OSHPD amendments
Division VI – Alternate Design Method **1926A – Alternate Design Method** (WSD or ASD)	-	NFPA 5000 does not contain Working Stress Design (WSD) or Allowable Stress Design (ASD) provisions, and ACI 318-02 Commentary Section R1.1 refers user to ACI 318-99 Appendix A. Evaluate need to adopt of Appendix A, ACI 318-99; if not adopted, allowance by OSHPD of ASD provisions will be discretionary
Division VII - Unified Design Provisions **1927A - Unified Design Provisions for Reinforced and Prestressed Concrete Flexural and Compression Members**	**Appendix B (ACI 318-02)** **Alternate Provisions for Reinforced and Prestressed Concrete Flexural and Compression Members**	Similar, provisions contained in referenced standard (ACI 318-02)
Division VIII - Alternative Load-Factor Combination and Strength Reduction Factors **1928A – Alternative Load-Factor Combination and Strength Reduction Factors**	**Appendix C (ACI 318-02)** **Alternate Load and Strength Reduction Factors**	Similar, provisions contained in referenced standard (ACI 318-02)
1929A – Testing and Inspection Entire section is OSHPD amendment	-	Evaluate and continue OSHPD amendments, may be placed within Chapter 17
A.1 Cementitious Material Test	-	Evaluate and continue OSHPD amendments, may be

2001 CBC – Chapter 19A	NFPA 5000 – Chapter 41	Comments
		placed within Chapter 17
A.2 Tests of Reinforcing Bars	-	Evaluate and continue OSHPD amendments, may be placed within Chapter 17
A.3 Tests for Prestressing Steel and Anchorage	-	Evaluate and continue OSHPD amendments, may be placed within Chapter 17
A.4 Batch Plant Inspection	-	Evaluate and continue OSHPD amendments, may be placed within Chapter 17
A.5 Waiver of Batch Plant Inspection	-	Evaluate and continue OSHPD amendments, may be placed within Chapter 17
A.6 Waiver of Material Testing	-	Evaluate and continue OSHPD amendments, may be placed within Chapter 17
A.7 Placing Record	-	Evaluate and continue OSHPD amendments, may be placed within Chapter 17
A.8 Composite Construction Cores	-	Evaluate and continue OSHPD amendments, may be placed within Chapter 17
A.9 Inspection of Prestressed Concrete	-	Evaluate and continue OSHPD amendments, may be placed within Chapter 17
A.10 Inspection of Pneumatically Placed Concrete Work (Shotcrete)	-	Evaluate and continue OSHPD amendments, may be placed within Chapter 17
A.11 Tests of Shotcrete.	-	Evaluate and continue OSHPD amendments, may be placed within Chapter 17
A.12 Inspection of Welded Reinforcing Bars	-	Evaluate and continue OSHPD amendments, may be placed within Chapter 17
A.13 Gypsum Field Tests	-	Evaluate and continue OSHPD amendments, may be placed within Chapter 17
1930A – Existing Concrete Structures (OSHPD amendment)	-	Evaluate and continue OSHPD amendment, may be located in either Chapter 17 or 19
Table 19A-A-1 Total Air Content for Frost-Resistant Concrete	**Table 4.2.1 (ACI 318-02)** Total Air Content for Frost-Resistant Concrete	Similar, table contained in ACI 318-02
Table 19A-A-2 Requirements for Special Exposure Conditions	**Table 4.2.2 (ACI 318-02)** Requirements for Special Exposure Conditions	Similar, table contained in ACI 318-02
Table 19A-A-3 Requirements for Concrete Exposed to De-icing Chemicals	**Table 4.2.3 (ACI 318-02)** Requirements for Concrete Exposed to De-icing Chemicals	Similar, table contained in ACI 318-02
Table 19A-A-4 Requirements for Concrete Exposed to Sulfate-Containing Solutions	**Table 4.3.1 (ACI 318-02)** Requirements for Concrete Exposed to Sulfate-Containing Solutions	Similar, table contained in ACI 318-02
Table 19A-A-5 Maximum Chloride Ion Content for Corrosion Protection Reinforcement	**Table 4.4.1 (ACI 318-02)** Maximum Chloride Ion Content for Corrosion Protection Reinforcement	Similar, table contained in ACI 318-02
Table 19A-A-6	**Table 5.3.1.2 (ACI 318-02)**	Similar, table contained in ACI 318-02

2001 CBC – Chapter 19A	NFPA 5000 – Chapter 41	Comments
Modification Factor for Standard Deviation When Less than 30 Tests are Available	Modification Factor for Standard Deviation When Less than 30 Tests are Available	
Table 19A-A-7 Required Average Compressive Strength When Data are not Available to Establish a Standard Deviation	**Table 5.3.2.2 (ACI 318-02)** Required Average Compressive Strength When Data are not Available to Establish a Standard Deviation	Similar, table contained in ACI 318-02
Table 19A-A-8 (OSHPD amendment) Concrete Mixes by Limiting Proportions	-	Evaluate for continuation (prescriptive method A mix), seems useful for small projects
Table 19A-B Minimum Diameters of Bend	**Table 7.2 (ACI 318-02)** Minimum Diameters of Bend	Similar, table contained in ACI 318-02
Table 19A-C-1 Minimum Thickness of Nonprestressed Beams or One-Way Slabs Unless Deflections are Computed	**Table 9.5 (a) (ACI 318-02)** Minimum Thickness of Nonprestressed Beams or One-Way Slabs Unless Deflections are Computed	Similar, table contained in ACI 318-02
Table 19A-C-2 Maximum Permissible Computed Deflections	**Table 9.5 (b) (ACI 318-02)** Maximum Permissible Computed Deflections	Similar, table contained in ACI 318-02
Table 19A-C-3 Minimum Thickness of Slabs Without Interior Beams	**Table 9.5 (c) (ACI 318-02)** Minimum Thickness of Slabs Without Interior Beams	Similar, table contained in ACI 318-02
Table 19A-D Allowable Service Load on Embedded Bolts (OSHPD amends)	-	Continue OSHPD amendments to CBC Table 19A-D as amendments to Appendix D of ACI 318-02
Table 19A-E Minimum Compressive Strength and Modulus of Elasticity and of Rigidity of Reinforced Gypsum Concrete	-	Review ASTM C 317, C 956 for equivalent provisions
Table 19A-F Allowable Unit Working Stress Reinforced Gypsum Concrete	-	Review ASTM C 317, C 956 for equivalent provisions
Table 19A-G Shear on Anchor Bolts and Dowels - Reinforced Gypsum Concrete	-	Review ASTM C 317, C 956 for equivalent provisions
Figure 19A-1 Minimum Extensions for Reinforcement in Slabs Without Beams	**Figure 13.3.8 (ACI 318-02)** Minimum Extensions for Reinforcement in Slabs Without Beams	Similar, Figure contained in ACI 318-02

Chapter 20A
Lightweight Metals
Comparison Summary

Chapter 20 in the *IBC* and Chapter 42 of *NFPA 5000*, cover the design of aluminum structures.

IBC 2003

IBC contains a general scope statement (Ch 20 covers aluminum design and construction), and references current Aluminum Association material design and construction standards for both ASD and LRFD. *IBC* text does not contain any design or construction provisions within the code text (as the 2001 *CBC* does).

NFPA 5000

NFPA 5000 Sec. 42.1 specifies, “Aluminum construction shall be designed and constructed in accordance with approved standards.” Per the Chapter 3 definition, “approved” refers to approval by the AHJ (OSHPD). Chapter 2 (referenced publications) lists the Aluminum Association Standard AA SAS 30, Aluminum Construction Manual Series, Section I, Specifications for Aluminum Structures, 1986. This publication is referenced in Sec. 35.1.2.8.5 of NFPA 5000, and is referenced for the purpose of deflection limitations.

Summary

Both model codes rely entirely on referenced standards.

Chapter 20A – Lightweight Metals

2001 CBC – Chapter 20A	IBC – Chapter 20	Comments
Division I - General **2001A – Material Standards and Symbols** A.1 General A.2 Alloys A.3 Symbols and Notations A.4 Identification	**2001 – General** **2002 – Materials** Referenced Standards: Aluminum Association (AA) - ASM 35-80 (Aluminum Sheet Metal Work in Building Construction) AA - Aluminum Design Manual (ADM 1-00); Part 1-A (ASD) and Part 1-B (LRFD)	IBC contains a general scope statement (Ch 20 covers aluminum design and construction), and references current Aluminum Association material and design & construction standards for both ASD and LRFD. IBC text does not contain any design or construction provisions within the code text (as the 2001 CBC does). Review referenced standards to verify that standards address the scope of design and construction currently addressed by the 2001 CBC, and utilize current standards.
2002A – Allowable Stresses for Members and Fasteners A.1 Allowable Unit Stresses A.2 Welded Structural Members A.3 Rivets and Bolts A.4 Fillet Welds	**-**	See comment above
2003A – Design A.1 Combined Stresses A.2 Light Gage Members A.3 Structural Roofing and Siding A.4 Connections	**-**	See comment above
2204A – Fabrication and Erection A.1 Cutting A.2 Fasteners A.3 Dissimilar Materials A.4 Painting A.5 Welding A.6 Welder Qualification A.7 Erection *A.8 Inspection of Welding*	**-**	See comment above Evaluate continuation of OSHPD amendment A.8
Table 20A-I-A Allowable Stresses for Rivets	**-**	See comment above
Table 20A-I-B Allowable Shear Stresses in Fillet Welds	**-**	See comment above
Table 20A-I-C General Formulas for Determining Allowable Stresses	**-**	See comment above

Chapter 20A – Lightweight Metals

2001 CBC – Chapter 20A	IBC – Chapter 20	Comments
Table 20A-I-D Factors of Safety for Use with Aluminum Allowable Stress Specifications	-	See comment above
Table 20A-I-E Formulas for Buckling Constants	-	See comment above
Table 20A-I-F Values of Coefficients	-	See comment above
Table 20A-I-G Formulas for Buckling Constants	-	See comment above
Division II – Design Standard for Aluminum Structures **2005A – Scope**	Referenced Standards: Aluminum Association (AA) – ASM 35-80 (Aluminum Sheet Metal Work in Building Construction) AA – Aluminum Design Manual (ADM 1-00); Part 1-A (ASD) and Part 1-B (LRFD)	CBC provisions based on Specifications for Aluminum Structures of the Aluminum Association (December, 1986) IBC references current Aluminum Association material and design & construction standards for both ASD and LRFD. Review referenced standards to verify that standards address the scope of design and construction currently addressed by the 2001 CBC, and utilize current standards.
2006A – Materials	-	See comment above
2007A – Design	-	See comment above
2008A – Allowable Stresses (references Div. I)	-	See comment above
2009A – Special Design Rules A.1 Combined Compression and Bending A.2 Torsion and Shear in Tubes A.3 Combined Shear, Compression and Bending A.4 Stiffeners for Outstanding Flanges A.5 Horizontal Stiffeners for Shear Webs A.6 Vertical Stiffeners for Shear Webs A.7 Special Provisions for Thin Sections A.8 Fatigue A.9 Compression in Single-web Beams A.10 Compression in Elastically Supported Flanges	-	See comment above

Chapter 20A – Lightweight Metals

2001 CBC – Chapter 20A	IBC – Chapter 20	Comments
2210A – Mechanical Connections A.1 Riveted and Bolted Connections A.2 Thread Forming Screws and Metal Stitching Staples A.3 Fasteners for Structural Formed Sheet Roofing and Siding	-	See comment above
2211A – Fabrication A.1 Laying Out A.2 Cutting A.3 Heating A.4 Punching, Drilling and Reaming A.5 Riveting A.6 Painting A.7 Cleaning and Treatment of Metal Surfaces	-	See comment above
2012A – Welded Construction A.1 Filler Wire A.2 Columns and Single-web Beams… A.3 Welding Fabrication	-	See comment above
2013A – Testing A.1 General A.2 Test Loading and Behavior	-	See comment above
Table 20A-II-A Minimum Mechanical Properties for Aluminum Alloys	-	See comment above
Table 20A-II-B Minimum Mechanical Properties for Welded Aluminum Alloys	-	See comment above

Chapter 20A – Lightweight Metals

2001 CBC – Chapter 20A	NFPA 5000 – Chapter 42	Comments
Division I - General **2001A – Material Standards and Symbols** A.1 General A.2 Alloys A.3 Symbols and Notations A.4 Identification	**42.1 General**	NFPA 5000 Sec. 42.1 specifies that "aluminum construction shall be designed and constructed in accordance with approved standards." Per chapter 3 definition, approved refers to approval by the AHJ (OSHPD). Chapter 2 (referenced publications) lists the Aluminum Association standard AA SAS 30, *Aluminum Construction Manual Series, Section I, Specifications for Aluminum Structures*, 1986. This publication is referenced in Sec. 35.1.2.8.5 of *NFPA 5000*, and is referenced for the purpose of deflection limitations. Adopt (by amendment) current AA standards pertaining to materials, design and construction. Review the (adopted) referenced standards to verify that standards address the scope of design and construction currently addressed by the 2001 CBC.
2002A – Allowable Stresses for Members and Fasteners A.1 Allowable Unit Stresses A.2 Welded Structural Members A.3 Rivets and Bolts A.4 Fillet Welds	**-**	See comments above.
2003A – Design A.1 Combined Stresses A.2 Light Gage Members A.3 Structural Roofing and Siding A.4 Connections	**-**	See comments above.
2204A – Fabrication and Erection A.1 Cutting A.2 Fasteners A.3 Dissimilar Materials A.4 Painting A.5 Welding A.6 Welder Qualification A.7 Erection *A.8 Inspection of Welding*	**-**	See comments above.
Table 20A-I-A Allowable Stresses for Rivets	**-**	See comments above.

Chapter 20A – Lightweight Metals

2001 CBC – Chapter 20A	NFPA 5000 – Chapter 42	Comments
Table 20A-I-B Allowable Shear Stresses in Fillet Welds	-	See comments above.
Table 20A-I-C General Formulas for Determining Allowable Stresses	-	See comments above.
Table 20A-I-D Factors of Safety for Use with Aluminum Allowable Stress Specifications	-	See comments above.
Table 20A-I-E Formulas for Buckling Constants	-	See comments above.
Table 20A-I-F Values of Coefficients	-	See comments above.
Table 20A-I-G Formulas for Buckling Constants	-	See comments above.
Division II – Design Standard for Aluminum Structures **2005A – Scope**	**42.1 General**	CBC provisions based on Specifications for Aluminum Structures of the Aluminum Association (December, 1986) NFPA 5000 Sec. 42.1 specifies that "aluminum construction shall be designed and constructed in accordance with approved standards." Per chapter 3 definition, approved refers to approval by the AHJ (OSHPD). Chapter 2 (referenced publications) lists the Aluminum Association standard AA SAS 30, *Aluminum Construction Manual Series, Section I, Specifications for Aluminum Structures*, 1986. This publication is referenced in Sec. 35.1.2.8.5 of *NFPA 5000*, and is referenced for the purpose of deflection limitations. OSHPD will adopt (by amendment) current AA standards pertaining to materials, design and construction.
2006A – Materials	-	See comments above.
2007A – Design	-	See comments above.
2008A – Allowable Stresses (references Div. I)	-	See comments above.

Chapter 20A – Lightweight Metals

2001 CBC – Chapter 20A	NFPA 5000 – Chapter 42	Comments
2009A – Special Design Rules A.1 Combined Compression and Bending A.2 Torsion and Shear in Tubes A.3 Combined Shear, Compression and Bending A.4 Stiffeners for Outstanding Flanges A.5 Horizontal Stiffeners for Shear Webs A.6 Vertical Stiffeners for Shear Webs A.7 Special Provisions for Thin Sections A.8 Fatigue A.9 Compression in Single-web Beams A.10 Compression in Elastically Supported Flanges	-	See comments above.
2210A – Mechanical Connections A.1 Riveted and Bolted Connections A.2 Thread Forming Screws and Metal Stitching Staples A.3 Fasteners for Structural Formed Sheet Roofing and Siding	-	See comments above.
2211A – Fabrication A.1 Laying Out A.2 Cutting A.3 Heating A.4 Punching, Drilling and Reaming A.5 Riveting A.6 Painting A.7 Cleaning and Treatment of Metal Surfaces	-	See comments above.
2012A – Welded Construction A.1 Filler Wire A.2 Columns and Single-web Beams… A.3 Welding Fabrication	-	See comments above.

Chapter 20A – Lightweight Metals

2001 CBC – Chapter 20A	NFPA 5000 – Chapter 42	Comments
2013A – Testing A.1 General A.2 Test Loading and Behavior	-	See comments above.
Table 20A-II-A Minimum Mechanical Properties for Aluminum Alloys	-	See comments above.
Table 20A-II-B Minimum Mechanical Properties for Welded Aluminum Alloys	-	See comments above.

Chapter 21A

Masonry

Comparison Summary

The masonry design chapters of both model codes reference the 2002 edition of the masonry standard, ACI 530-02/ASCE 5-02/TMS 402-02, which we will refer to as *ACI 530-02*. Potential coordination and safety issues will arise from the fact that the primary structural reference, *ASCE 7-02*, refers to the 1999 edition of the masonry standard, *ACI 530-99*. There are significant differences in both the content and organization between the two editions masonry standard, which impact seismic design procedures.

At the national level, *ACI 530-02* is currently being considered for adoption into the 2003 edition of the *NEHRP Provisions*, with subsequent adoption into the 2005 edition of *ASCE 7* (*ASCE 7-05)*. The Building Seismic Safety Council (BSSC), author of the NEHRP Provisions, is considering a total of 11 proposals relating to seismic design of masonry, many of which substantially modify *ACI 530-02*.

IBC 2003

Masonry design provisions are covered in the 29 pages of *IBC* Chapter 21. The chapter contains provisions for both analytical and empirical design. *IBC* Chapter 21 also covers the structural design and anchorage of masonry chimneys in considerable depth.

Few if any conflicts arise from the adoption of both *ASCE 7-02* and *ACI 530-02* in the *IBC*, because *IBC* does not adopt *ASCE 7-02*, Section A9.11, (the section that references *ACI 530-99*). Instead, *IBC* Chapter 21 contains a complete set of seismic design regulations for masonry. These regulations make reference to and are coordinated with the appropriate sections of *ACI 530-02*, and appear to embrace a number of the issues covered in the proposed amendments to *ACI 530-02* being considered for the *2003 NEHRP* provisions.

NFPA 5000

NFPA 5000, Chapter 43 covers masonry design in a little over one-half page, Chapter 43 basically references *ACI 530-02*, without amendment, for nearly all aspects of masonry design. The referenced publication for masonry chimneys, *NFPA 211*, does not appear to cover structural design or anchorage provisions.

Due to the organizational changes made to *ACI 530-02*, the many references in *ASCE 7-02*, Section A9.11, “Supplementary Provisions for Masonry” no longer correspond to the correct references in the masonry standard. In *NFPA 5000*, no discernable effort has been made to coordinate these references. As a result, of the 11 specific section references in *ASCE 7-02* to sections in the masonry standard, 4 are correct, 2 refer to incorrect sections in *ACI 530-02*, and 5 refer to sections that do not exist. It should be noted that since Section 43.2 of *NFPA 5000* refers specifically to *ACI 530-02*, it would be a violation of Section 1.3.2 of *NFPA 5000* code to substitute *ACI 530-99*, the edition referenced in *ASCE 7-02*, for *ACI 530-02*.

Aside from the coordination issues, technical issues surround NFPA's adoption of *ACI 530-02* without amendment. The level of safety provided by *ACI 530-02* as adopted by *NFPA 5000*, without the inclusion of the proposed modifications, is unacceptable.

Summary

No significant conflicts arise from the adoption of both *ASCE 7-02* and *ACI 530-02* in the *IBC*, since *IBC* does not adopt *ASCE 7-02*, Section A9.11, (the section that references *ACI 530-99*). Instead, *IBC* Chapter 21 contains a complete set of seismic design regulations for masonry. *IBC* is coordinated with the appropriate sections of *ACI 530-02*, and appears to embrace a number of the issues covered in the proposed amendments to *ACI 530-02* being considered for the 2003 *NEHRP Provisions*.

In contrast, *NFPA 5000* adopts *ACI 530-02* without amendment, thereby creating significant conflicts. In order to apply *NFPA 5000* to masonry design, users must possess both the 1999 and 2002 masonry standards, and coordinate the section references for themselves. Even then, important safety-related changes to the 2002 masonry standard will only be apparent if the user refers to the 2003 *NEHRP Provisions* or the 2005 edition of *ASCE 7* (*ASCE 7-05*), neither of which are available at this time.

Chapter 21A - Masonry

2001 CBC – Chapter 21A	IBC – Chapter 21	Comments
2101A – General	**2101 - General**	Similar
A.1 Scope	1.1. Scope	Similar
A.2 Design Methods	1.2. Design methods	Similar
A2.1 Working stress design	1.2.1. Working stress design	Similar
-	1.2.3. Prestressed masonry	No provisions for prestressed masonry in CBC.
-	1.2.6. Masonry veneer	CBC requirements for Veneer are in Section 1403A.
-	1.3. Construction documents	Provisions in Part 1 of CBC
-	1.3.1. Fireplace drawings	Fireplace provisions are in Chapter 31of CBC
A.2.2 Strength design	1.2.2. Strength design	Similar
A.2.3 Empirical design	1.2.4. Empirical design	Similar
A.2.4 Glass masonry	1.2.5. Glass masonry	Similar
A.3 Definitions A.4 Notations	**2102 - Definitions and Notations**	Similar
2102A - Material Standards	**2103 - Masonry Construction Materials**	Similar
A.1 Quality A.2 Standards of Quality	2.1. Concrete masonry units	Similar
	2.2. Clay or shale masonry units	Similar
	2.3. Stone masonry units	Similar
	2.4. Ceramic tile	Similar
	2.5. Glass unit masonry	Similar
	2.6. Second-hand units	Similar
2103A - Mortar and Grout A.3 Mortar A.3.1 General A.3.2 Selecting proportions	2.7. Mortar **Table 2103.7 (2)** Mortar Properties	Similar
-	2.8. Surface-bonding mortar	Minimal Impact
-	2.9. Mortars for ceramic wall and floor tile **Table 2103.9** Ceramic Tile Mortar Compositions	Minimal Impact
A.4 Grout.	2.10. Grout	Similar
A.2 Materials Standards Item 7 and 10	2.11. Metal reinforcement … 2.11.1 Deformed reinforcing bars 2.11.2 Joint reinforcement 2.11.3 Deformed reinforcing wire 2.11.4 Wire fabric 2.11.5 Anchors, ties and acces. 2.11.6 Prestressing tendons	Similar

2001 CBC – Chapter 21A	IBC – Chapter 21	Comments
	2.11.7 Corrosion protection 2.11.8 Tests	
A.5 Additives and Admixtures. A.5.1 General A.5.2 Antifreeze compounds A.5.3 Air entrainment A.5.4 Colors	ACI 530.1 Section 2.1, 2.2 through reference to ASTM's for mortar and grout. ACI 530.1 Section 2.6 item 2 and 3.	Minimal Impact
2104A - Construction	**2104 - Construction**	
A.1 General	4.1. Masonry construction – Requires masonry construction to be in accordance with the code and ACI 530.1.	Minimal impact
A.2 Materials: Handling, Storage and Preparation	ACI 530.1 Section 1.7.	Minimal impact
A.3 Cold-weather Construction.	4.3. Cold-weather construction	Minimal Impact
A.4 Placing Masonry Units.	4.1.2 Placing mortar and units	Similar
A.4.1 Mortar	4.1.2.1 Bed and head joints	Similar
A.4.2 Surfaces	-	Minimal Impact
A.4.3 Solid masonry units	4.1.2.3 Solid units	Similar
A.4.4 Hollow-masonry units	4.1.2.2 Hollow units	Similar
2307A - Wood Supporting Masonry or Concrete	4.1.6 Support on wood	Minimal Impact
A.4.5 Corbeling	4.2. Corbelled masonry 4.2.1 Molded cornices	Minimal Impact
-	4.4. Hot weather construction 4.5. Wetting of brick	No requirements found in CBC.
A.5 Reinforcement Placing	ACI 530.1 Section 3.4. – Reinforcement, tie and anchor installation.	Minimal impact
A.6 Grouted Masonry A.6.1 General conditions	ACI 530.1 Section 3.2. – Preparation.	Minimal impact
A.6.1.1 Reinforced grouted masonry	ACI 530.1 Section 3.5. – Grout placement.	5 ft maximum lifts in ACI. Requires further evaluation
A.6.1.1.1 General		
A.6.1.1.2 Low-lift grouted construction		
A.6.1.1.3 High-lift grouted construction		
A.6.1.2 Reinforced hollow-unit masonry.		
A.6.1.2.1 General		

2001 CBC – Chapter 21A	IBC – Chapter 21	Comments
A.6.1.2.2 Low-lift grouted construction *A.6.1.2.3 High-lift grouted construction*		
A.6.1.2.4 Stresses	ACI 530.1 Section 3.5 C. – Grout pour height per Table 7.	Requires further evaluation
A.6.2 Construction requirements	ACI 530.1 Section 3.4. (reinforcement, tie, and anchor installation) and 3.5 (grout placement).	Requires further evaluation
A.7 Aluminum Equipment	-	Minimal impact
A.8 Joint Reinforcement	ACI 530, Section 1.12.4.2 – Reinforcement Protection. ACI 530, Section 7.7 ACI 530.1, Section 2.4 C and E.	ACI Requirements are not consistent with CBC requirements.
2105A – Quality Assurance	**2105 – Quality Assurance**	Similar
A.1 General A.2 Scope	5.1. General – Quality assurance program. Reference to Chapt. 17.	Minimal impact
A.3 Compliance with *f'm* *A.3.0 f'm*	5.2. Acceptance relative to strength requirements 5.2.1 Compliance with f'm	Minimal impact
A.3.1 *Masonry core testing*		Amendment language in CBC. No equivalent language found in IBC.
A.3.2 Masonry prism testing A.3.3 Masonry prism test record	5.2.2.2 Prism test method. 5.2.2.2.1 General 5.2.2.2.2 Number of prisms per test	Minimal impact
A.3.4 Unit strength method	5.2.2 Determination of compressive strength 5.2.2.1 Unit strength method 5.2.2.1.1 Clay masonry 5.2.2.1.2 Concrete masonry	Minimal impact
A.3.5 Testing prisms from constructed masonry Paragraph 1 Paragraph 2 Paragraph 3	5.3. Testing prisms from constructed masonry 5.3.1 Prism sampling and removal 5.3.2 Compressive strength calcs. 5.3.3 Compliance	Minimal impact
A.6 Combination of Units		Amendment language in CBC. No equivalent language found in IBC.
A.7 Masonry Inspection		Amendment language in CBC. No equivalent language found in IBC. IBC Chapter 17 requires continuous inspection for grouting, welding reinf. … but not laying masonry units.

Chapter 21A - Masonry

2001 CBC – Chapter 21A	IBC – Chapter 21	Comments
2106A - General Design Requirements A.1 General	ACI 530 Chapter 1 – General Design requirements for masonry	IBC Design Sections 2106 (Seismic), 2107 (Working Stress), 2108 (Strength), and 2109 (Empirical), reference ACI 530.
A.1.1 Scope	ACI 530 Section 1.1 - Scope	Minimal impact
A.1.2 Plans	ACI 530 Section 1.2 – Contract Documents	Minimal impact
A.1.3 Design loads.	ACI 530 Section 1.7 - Loading	Minimal impact
A.1.4 Stack bond	ACI 530 Section 1.11 – Stack Bond	Minimal impact
A.1.5 Multiwythe walls.	ACI 530 Section 2.1.5 – Multiwythe walls	Minimal impact
A.1.6 Vertical support – Not allowed to be supported by wood.	2104.1.5 Lintels 2104.1.6 Support on wood	Minimal impact
A.1.7 Lateral support	-	Minimal impact
A.1.8 Protection of ties and joint reinforcement	ACI 530 Section 1.2.4 – Protection of Reinforcement	Minimal impact
A.1.9 Pipes and conduits embedded in masonry	ACI 530 Section 1.15.2 – Embedded conduits, pipes, and sleeves.	Minimal impact
A.1.10 Load tests	-	Minimal impact
A.1.11 Reuse of masonry units	-	Minimal impact
A.1.12 Special provisions in areas of seismic risk. A.1.12.1 General A.1.12.4 Special provisions for Seismic Zones 3 and 4	**2106 Seismic Design** 6.1. Seismic design requirements for masonry 6.1.1 Basic seismic-force-resisting system 6.1.1.1 Ordinary plain prestressed masonry shear walls 6.1.1.2 Intermediate prestressed masonry shear walls 6.1.1.3 Special prestressed masonry shear walls 6.2. Anchorage of masonry walls 6.3. Seismic Design Category B 6.3.1 Masonry walls not part of the lateral force resisting system 6.4. Additional requirements for structures in Seismic Design Category C 6.4.1 Design of Discontinuous members that are not part of the lateral-force-resisting system. 6.5. Additional requirements for structures in Seismic Design Category D	There are no prestressed masonry provisions in CBC. There are no prestressed masonry provisions in CBC. There are no prestressed masonry provisions in CBC.

2001 CBC – Chapter 21A	IBC – Chapter 21	Comments
	6.6. Additional requirements for structures in Seismic Design Category E or F	
A.2 Working Stress Design and Strength Design Requirements for Unreinforced and Reinforced Masonry. A.2.1 General	-	
A.2.3.3 *Walls and Piers. Thickness ofWalls*	ACI 530 Section 1.6 – Definitions Pier	CBC Dimensional limits are different from ACI limits.
A.2.4 Effective height	ACI 530 Section 1.6 – Definitions Effective height	Minimal impact
A.2.5 Effective area	ACI 530 Section 1.6 – Definitions Area, net cross-sectional	Minimal impact
A.2.6 Effective width of intersecting walls	ACI 530 Section 1.9.4 – Intersecting Walls	Minimal impact
A.2.7 Distribution of concentrated vertical loads in walls	ACI 530 Section 2.1.9 – Concentrated loads	ACI requirement is in Allowable Stress Design chapter. Unable to find similar requirement in Strength Design chapter.
A.2.14 Placement of embedded anchor bolts	ACI 530 Section 2.1.4 – Anchor Bolts Solidly Grouted in Masonry. ACI 530 Section 3.1.6 – Headed and bent-bar anchor bolts.	ACI includes plate anchors, headed anchor bolts and J or L anchor bolts. CBC requires Hex Head anchor bolts.
A.3 Working Stress Design and Strength Design Requirements for Reinforced Masonry A.3.1 General	-	Similar provisions noted below
A.3.2 Plain bars	-	No effect
A.3.3 Spacing of longitudinal reinforcement	ACI 530 Section 1.12.3 – Placement of reinforcement	Minimal impact
A.3.4 Anchorage of flexural reinforcement	ACI 530 Section 2.1.10.3 – Embed. Of flexural reinforcement	This requirement was only found in the working stress design chapter of ACI. Appears to be general requirement that applies to both working stress and strength design.
A.3.5 Anchorage of shear reinforcement	ACI 530 Section 2.1.10.5 and ACI 530 Section 3.2.3.3.1 Development of shear reinforcement.	Minimal impact
A.3.6 Lateral ties	ACI 530 Section 2.1.6.5 and ACI 530 Section 3.2.4.4.2 – Lateral Ties	Minimal impact
A.3.7 Column anchor bolt ties	-	Requirement not found in IBC/ACI
A.3.8 Effective width *b* of compression area	ACI 530 Section 2.3.3.3 – Effective compressive width per bar.	This requirement was only found in the working stress design chapter of ACI. Appears to be general requirement that applies to both working stress and

2001 CBC – Chapter 21A	IBC – Chapter 21	Comments
		strength design.
2107A Working Stress Design of Masonry A.1 General. A.1.1 Scope	**2107 Working Stress Design** 7.1. General 7.2. Modifications to ACI 530/ASCE 5/TMS 402. 7.2.1 ACI 530/ASCE 5/TMS 402, Chapter 2 7.2.2 ACI 530/ASCE 5/TMS 402, 2.1.6 7.2.3 ACI 530/ASCE 5/TMS 420, 7.2.1.10.6.1.1, lap splices 7.2.4 ACI 530/ASCE 5/TMS 402, maximum bar size 7.2.5 ACI 530/ASCE 5/TMS 402, splice for large bars.	Requires further evaluation
A.1.3 Minimum dimensions for masonry structures located in Seismic Zones 3 and 4.	-	Requirement not found in IBC/ACI, evaluate for continuation as amendment to IBC
A.1.5 Embedded anchor bolts	ACI 530 Section 2.1.4 – Anchor Bolts …	Minimal impact
A.1.6 Compression in walls and columns	ACI 530 Section 2.1.9 – Concentrated loads	Minimal impact
A.1.7 Shear walls, design loads	2106.5.1 – Loads for Shearwalls Designed by the Working Stress Method	Load increase is only require for Seismic Design Category C and greater.
A.1.8 Design, composite construction	ACI 530 Section 2.1.5.2 – Composite action	Detailed comparison of the two sections should be performed to evaluate the need for amendment(s).
A.1.9 Reuse of masonry units	2103.6 Second hand units	CBC requires using 50 percent of the allowable stress for new units. No reduction in IBC.
A.2 Design of Reinforced Masonry	ACI 530 Section 2.3 - Reinforced Masonry	Similar
A.2.1 Scope – requirements for masonry with reinforcement.	ACI 530 Section 2.3.1 Scope – requirements for allowable stress design …	Scope of two codes is similar however a detailed comparison of the two codes should be performed to evaluate the need to amend IBC/ACI 530.
2108A - Strength Design of Masonry	**2108 Strength Design of Masonry** 8.2. ACI 530/ASCE 5/TMS 402, Section 3.2.2(g) 8.3. ACI 530/ASCE 5/TMS 402, Section 3.2.3.4 8.4. ACI 530/ASCE 5/TMS 402, Section 3.2.3.5.1	Requires further evaluation
A.1 General A.1.1 General provisions	8.1. General ACI 530 Section 3.1 – General ACI 530 Section 3.1.1 - Scope	ACI includes unreinforced masonry which is not allowed by CBC
A.2 Reinforced Masonry	ACI 530 Section 3.2 - Reinforced	Similar

2001 CBC – Chapter 21A	IBC – Chapter 21	Comments
	Masonry	
A.2.1 General	ACI 530 Section 3.2.1 – Scope Masonry design with reinforcement.	Scope of two codes is similar however a detailed comparison of the two codes should be performed to evaluate the need to amend IBC/ACI 530.
A.2.3 Design of beams, piers and columns	ACI 530 Section 3.2.4.3 - Piers	
A.2.4 Wall design for out-of-plane loads	ACI 530 Section 3.2.5 – Wall design for out-of-plane loads	
A.2.5 Wall design for in-plane loads	ACI 530 Section 3.2.6 – Wall design for in-plane loads	
A.2.6 Design of moment-resisting wall frames	-	No provisions for moment resisting wall frames found in ACI.
-	ACI Section 3.3 - Unreinforced (Plain) Masonry	Unreinforced masonry is not allowed under CBC. Evaluate for non-adoption by OSHPD
-	ACI 530 Chapter 4 - Prestressed Masonry	No provisions for prestressed masonry in CBC. Evaluate for adoption (or non-adoption)
2109A Empirical Design of Masonry A.1 General CBC limits use of empirically designed masonry to: 1) Buildings in Seismic Zones 0 and 1 *(this renders 2109A inapplicable to OSHPD projects)* 2) Buildings designed for a wind speed less than 80 mph. 3) Buildings less than 35 feet in height. A.2 Height A.3 Lateral Stability A.4 Compressive Stresses A.5 Lateral Support A.6 Minimum Thickness A.7 Bond A.8 Anchorage A.9 Unburned Clay Masonry	**2109 - Empirical Design of Masonry** 9.1 General 9.1.1 Limitations 1) Elements not part of the seismic load resisting system of buildings in Seismic Design Categories A and B. 2) Masonry structures in areas with 110 mph wind speed (3-second gust). 3) Buildings greater than 35 feet in height. 9.2 Lateral Stability 9.3 Compressive Stresses 9.4 Lateral support. **Table 2109.4.1** Wall Lateral Support Requirements 9.5 Thickness of masonry. 9.6 Bond 9.7 Anchorage. 9.8 Adobe construction	Under the IBC, OSHPD could see buildings falling in Seismic Design Category B that would allow empirical design masonry to be used for non-structural partition walls.
A.10 Stone Masonry	9.5.3 Rubble Stone Walls 9.6.4 Bonding with natural or cast stone.	
Table 16A-V Maximum Diaphragm Dimension Ratios	**Table 2109.2.1.3** Diaphragms Length-to-Width Ratios	Minimal impact

2001 CBC – Chapter 21A	IBC – Chapter 21	Comments
No provisions found for dry stacked walls	**Table 2109.2.3.1** Allowable Stress Gross Cross-Sectional Area for Dry-Stacked, Surface-Bonded Concrete Masonry Walls	Requires further evaluation
Table 21A-M Allowable Compressive Stresses for Empirical Design of Masonry (not adopted by OSHPD)	**Table 2109.3.2** Allowable Compressive Stresses for Empirical Design of Masonry	Referenced table in CBC column is a UBC table not adopted by OSHPD.
Table 21A-P Thickness of Foundation Walls for Empirical Design of Masonry (not adopted by OSHPD)	**Table 2109.5.6.1** Foundation Wall Construction	Referenced table in CBC column is a UBC table not adopted by OSHPD
Table 21A-Q Allowable Shear on Bolts for Masonry of Unburned Clay (not adopted by OSHPD)	**Table 2109.8.3.1** Allowable Shear on Bolts in Adobe Masonry	Referenced table in CBC column is a UBC table not adopted by OSHPD.
2110A - GLASS MASONRY A.1 General A.2 Mortar Joints (2110A.1 refers to Sec. 2113A for requirements)	**2110 - Glass Unit Masonry** 10.1 Scope 10.2 Units. Hollow or solid glass block units shall be standard or thin units. 10.3 Panel size. Figure 2110.3.1 Glass Masonry Design Wind Load Resistance 10.4 Support. 10.5 Expansion joints 10.6 Mortar 10.7 Reinforcement 2104.1.2.4 Glass unit masonry	Requires further evaluation
2111A - Chimneys, Fireplaces and Barbecues (CBC Refers to Chapter 31 of the CBC for design and construction requirements)	**2111 - Masonry Fireplaces** **2113 Masonry Chimneys**	See comparison of CBC Chapter 31
2112A NONBEARING WALLS (entire section is OSHPD amendment)	ACI 530 Section 1.13.5.2.2 Masonry Partition Walls, Screen Walls	The IBC does not have a specific reference to ACI 530 for partitions and screen walls, but references ACI 530 under specific masonry design methods. CBC amendment language has more specific/detailed requirements.
2113A - MASONRY SCREEN WALLS (entire section is OSHPD amendment)	ACI 530 Section 1.13.5.2.2 Masonry Partition Walls, Screen Walls	The IBC does not have a specific reference to ACI 530 for partitions and screen walls, but references ACI 530 under specific masonry design methods. CBC amendment language has more specific requirements.

2001 CBC – Chapter 21A	IBC – Chapter 21	Comments
2114A - USE OF EXISTING MASONRY (entire section is OSHPD amendment) *A.1 General* – limits use. Existing masonry must meet reinforced grouted masonry requirements to be used for structural purpose.	-	No provisions found in IBC chapter 21.
2115A TESTS AND INSPECTIONS (entire section is OSHPD amendment) *A.1 See Section 2105A*	IBC Chapter 17.	See comparison of CBC Chapter 17A.
Table 21A-A Mortar Proportions for Unit Masonry	**Table 2103.7 (1)** Mortar Proportions	Similar
Table 21A-B Grout Proportions by Volume	**Table 2103.10** Grout Proportions by Volume for Masonry Construction	Similar
Table 21A-C Grouting Limitations	ACI 530.1 – Table 7	The tables differ and should be compared to determine if amendment is required.
Table 21A-D Specified Compressive Strength of Masonry, *f'm* (psi) Based on Specifying the Compressive Strength of Masonry	**Table 2105.2.2.1.1** Compressive Strength of Clay Masonry **Table 2105.2.2.1.2** Compressive Strength of Concrete Masonry	Minimal impact
Table 21A-E-1 Allowable Tension, *Bt* , for Embedded Anchor Bolts for Clay and Concrete Masonry	-	No Table found in IBC/ACI 530
Table 21A-E-2 Allowable Tension, *Bt* , for Embedded Anchor Bolts for Clay and Concrete Masonry	-	No Table found in IBC/ACI 530
Table 21A-F Allowable Shear, *Bv*, for Embedded Anchor Bolts for Clay and Concrete Masonry	-	No Table found in IBC/ACI 530
Table 21A-G Minimum Diameters of Bend	ACI 530 Table 1.12.6.1	ACI Table includes bend diameter for #3 -#7 bars of grade 40 steel.
Table 21A-H-1 Radius of Gyration for Concrete Masonry Units	-	No Table found in IBC/ACI 530
Table 21A-H-2	-	No Table found in IBC/ACI 530

2001 CBC – Chapter 21A	IBC – Chapter 21	Comments
Radius of Gyration for Clay Masonry Unit Length, 16 Inches		
Table 21A-H-3 Radius of Gyration for Clay Masonry Unit Length, 12 Inches	-	No Table found in IBC/ACI 530
Table 21A-I Allowable Flexural Tension (psi)	ACI 530 Table 2.2.3.2	The tables differ and should be compared to determine if amendment is required.
Table 21A-J Maximum Nominal Shear Strength Values	ACI 530 Section 3.2.4.1 – Nominal strength. Formulas (3-19) & (3-20)	CBC limits the nominal shear strength, ACI 530 does not appear to have limits. Verify if A_e used in CBC is equivalent to A_n used in ACI.
Table 21A-K Nominal Shear Strength Coefficient	ACI 530 Section 3.2.4.1 – Nominal strength. Formula (3-21).	This section will require further evaluation to determine if there is a difference between the CBC and ACI 530. CBC limits the nominal shear strength, ACI 530 does not appear to have limits.
Table 21A-R *Minimum Thickness of Masonry*	ACI 530 Section 5.6 – Thickness of masonry	Cited ACI 530 section is specific to Empirical design of masonry. CBC minimum thickness requirements are general and cited in various CBC sections.

Chapter 21A - Masonry

2001 CBC - Chapter 21A	NFPA 5000 – Chapter 43	Comments
2101A - General	**43.2 General**	-
A.1 Scope – Material, Design, construction and quality assurance of masonry.	43.1 Scope – Design and const. Of masonry. 43.2 General – Reference to ACI 530/ASCE 5/TMS 402.	NFPA 5000 references ACI 530-02 for masonry design and construction provisions, with a few additional requirements contained in NFPA 5000, including 43.6 and 43.7.
A.2 Design Methods A.2.1 Working stress design A.2.2 Strength design - A.2.3 Empirical design - A.2.4 Glass masonry	43.3 Design (1) Working stress design (2) Strength design (3) Prestressed Masonry (4) Empirical design (5) Veneer (6) Glass masonry	Evaluate pre-stress design provisions
-	43.4 Construction documents	Minimal impact
-	43.7 Masonry Construction – Reference to ACI 530.1/ASCE 6/TMS 602.	NFPA 5000 specifies that masonry construction is to comply with ACI 530-02 provisions and additional provisions contained in NFPA 5000 43.7.1 through 43.7.4 (open-end unit requirements). This conflicts with the reference to ASCE 7-02 Section 9.11 to ACI 530-99.
A.3 Definitions	ACI Section 1.6 - Definitions	Provisions contained in referenced standard
A.4 Notations	ACI Section 1.5 - Notations	Provisions contained in referenced standard
2102A - Material Standards A.1 Quality A.2 Standards of Quality	43.6 Masonry Construction Materials References ACI 530, 530.1	Provisions contained in referenced standard
2103A - Mortar and Grout A.1 General A.2 Materials A.3 Mortar A.3.1 General A.3.2 Selecting proportions	43.6 Masonry Construction Materials ACI 530.1 Section 2.1 – Mortar materials. Requirements by reference to ASTM C 270	Provisions contained in referenced standard ASTM C 270-99b (Approx. 4 pages)
A.4 Grout A.4.1 General A.4.2 Selecting proportions *A.4.3 Aggregate*	ACI 530.1 Section 2.2 – Grout materials. Requirements by reference to ASTM C 476	ASTM C 476-99 (2 pages)
A.5 Additives and Admixtures. A.5.1 General A.5.2 Antifreeze compounds A.5.3 Air entrainment A.5.4 Colors	ACI 530.1 Section 2.1, 2.2 through reference to ASTM's for mortar and grout. ACI 530.1 Section 2.6 item 2 and 3.	Minimal impact
2104A - Construction	43.7 Masonry Construction References 43.7.1 through 43.7.4,	Provisions mostly contained in referenced Standard ACI 530.1, which is a model specification

2001 CBC - Chapter 21A	NFPA 5000 – Chapter 43	Comments
	and ACI 530.1 provisions	
A.1 General	43.7	Provisions contained in referenced standard
A.2 Materials: Handling, Storage and Preparation	ACI 530.1 Section 1.7.	Provisions contained in referenced standard
A.3 Cold-weather Construction.	ACI 530.1 Section 1.8 C. – Cold weather construction.	Provisions contained in referenced standard
-	ACI 530.1 Section 1.8 D. – Hot weather construction	No requirements found in CBC.
A.4 Placing Masonry Units.	ACI 530.1 Section 3.3. – Masonry Erection.	Provisions contained in referenced standard
A.4.1 Mortar		
A.4.2 Surfaces		
A.4.3 Solid masonry units		
A.4.4 Hollow-masonry units		
A.4.5 Corbeling		
A.5 Reinforcement Placing	ACI 530.1 Section 3.4. – Reinforcement, tie and anchor installation.	Provisions contained in referenced standard
A.6 Grouted Masonry. A.6.1 General conditions	ACI 530.1 Section 3.2. – Preparation.	Provisions contained in referenced standard
A.6.1.1 Reinforced grouted masonry.	ACI 530.1 Section 3.5. – Grout placement.	Provisions contained in referenced standard 5 ft maximum lifts in ACI. Requires further evaluation
A.6.1.1.1 General		
A.6.1.1.2 Low-lift grouted construction		
A.6.1.1.3 High-lift grouted construction		
A.6.1.2 Reinforced hollow-unit masonry.		
A.6.1.2.1 General		
A.6.1.2.2 Low-lift grouted construction		
A.6.1.2.3 High-lift grouted construction		
A.6.1.2.4 Stresses	ACI 530.1 Section 3.5 C. – Grout pour height per Table 7.	Requires further evaluation
A.6.2 Construction requirements	ACI 530.1 Section 3.4. (reinforcement, tie, and anchor installation) and 3.5 (grout placement).	Requires further evaluation
A.7 Aluminum Equipment	-	Continue CBC provision
A.8 Joint Reinforcement	ACI 530, Section 1.12.4.2 – Reinforcement Protection.	Provisions contained in referenced standard ACI Requirements are not consistent with CBC

2001 CBC - Chapter 21A	NFPA 5000 – Chapter 43	Comments
	ACI 530, Section 7.7 ACI 530.1, Section 2.4 C and E.	requirements.
2105A - Quality Assurance	43.5 Quality Assurance	Sec. 43.5 references Sec. 40.3.9, which makes general reference to ACI 530. Review of ACI 530 Sec. 1.14 indicates several issues to be addressed via amendment, including: - define Level 1, 2, or 3 QA - define criteria for lab/inspector approval - QA program requirements not defined, will need amendments to clarify also – 40.1.6.1 contractor quality control program Also – ACI 530 references ACI 530.1, which contains a model specification for design professionals to incorporate into project documents, and contains more specific requirements for materials than ACI 530 Sec. 1.14
A.1 General		
A.2 Scope		
A.3 Compliance with *f'm*		
A.3.0 f'm		
A.3.1 *Masonry core testing*		
A.3.2 Masonry prism testing		
A.3.3 Masonry prism test record		
A.3.4 Unit strength method		
A.3.5 Testing prisms from constructed masonry		
A.6 Combination of Units		
A.7 Masonry Inspection		
2106A - General Design Requirements	ACI 530 Ch. 1 – General Design Requirements for Masonry	Provisions contained in referenced standard ACI 530
A.1 General.	-	No effect
A.1.1 Scope	ACI 530 Section 1.1 - Scope	Minimal impact
A.1.2 Plans	ACI 530 Section 1.2 – Contract Documents	Minimal impact
A.1.3 Design loads.	ACI 530 Section 1.7 - Loading	Minimal impact
A.1.4 Stack bond	ACI 530 Section 1.11 – Stack Bond	Minimal impact
A.1.5 Multiwythe walls.	ACI 530 Section 2.1.5 – Multiwythe walls	Minimal impact
A.1.6 Vertical support	-	Minimal impact
A.1.7 Lateral support	-	Minimal impact
A.1.8 Protection of ties and joint reinforcement	ACI 530 Section 1.2.4 – Protection of Reinforcement	Minimal impact
A.1.9 Pipes and conduits embedded in masonry	ACI 530 Section 1.15.2 – Embedded conduits, pipes, and sleeves.	Minimal impact
A.1.10 Load tests	-	Minimal impact
A.1.11 Reuse of masonry units	43.6.1 Second-Hand Units	Minimal impact

Chapter 21A - Masonry

2001 CBC - Chapter 21A	NFPA 5000 – Chapter 43	Comments
A.1.12 Special provisions in areas of seismic risk. A.1.12.1 General A.1.12.4 Special provisions for Seismic Zones 3 and 4	43.8 Seismic requirements 43.8.1 General – Reference to Section 1.13 of ACI 530/ASCE 5/TMS 402. 43.8.2 One- and Two-Family Dwellings	Requires further evaluation
A.2 Working Stress Design and Strength Design Requirements for Unreinforced and Reinforced Masonry. A.2.1 General	-	
A.2.3.3 *Walls and Piers. Thickness of Walls per Table 21A-R.*	ACI 530 Section 1.6 – Definitions Pier	CBC Dimensional limits are different from ACI limits.
A.2.4 Effective height	ACI 530 Section 1.6 – Definitions Effective height	Minimal impact
A.2.5 Effective area	ACI 530 Section 1.6 – Definitions Area, net cross-sectional	Minimal impact
A.2.6 Effective width of intersecting walls	ACI 530 Section 1.9.4 – Intersecting Walls	Minimal impact
A.2.7 Distribution of concentrated vertical loads in walls	ACI 530 Section 2.1.9 – Concentrated loads	ACI requirement is in Allowable Stress Design chapter. Unable to find similar requirement in Strength Design chapter.
A.2.14 Placement of embedded anchor bolts	ACI 530 Section 2.1.4 – Anchor Bolts Solidly Grouted in Masonry. ACI 530 Section 3.1.6 – Headed and bent-bar anchor bolts.	ACI includes plate anchors, headed anchor bolts and J or L anchor bolts. CBC requires Hex Head anchor bolts.
A.3 Working Stress Design and Strength Design Requirements for Reinforced Masonry A.3.1 General	-	-
A.3.2 Plain bars	-	Minimal impact
A.3.3 Spacing of longitudinal reinforcement	ACI 530 Section 1.12.3 – Placement of reinforcement	Minimal impact
A.3.4 Anchorage of flexural reinforcement	ACI 530 Section 2.1.10.3 – Embed. of flexural reinforcement	This requirement was only found in the working stress design chapter of ACI. Appears to be general requirement that applies to both working stress and strength design.
A.3.5 Anchorage of shear reinforcement	ACI 530 Section 2.1.10.5 and ACI 530 Section 3.2.3.3.1 Development of shear reinforcement.	Minimal impact
A.3.6 Lateral ties	ACI 530 Section 2.1.6.5 and ACI 530 Section 3.2.4.4.2 – Lateral Ties	Minimal impact

Chapter 21A - Masonry

2001 CBC - Chapter 21A	NFPA 5000 – Chapter 43	Comments
A.3.7 Column anchor bolt ties	-	Requirement not found in NFPA/ACI
A.3.8 Effective width *b* of compression area	ACI 530 Section 2.3.3.3 – Effective compressive width per bar.	This requirement was only found in the working stress design chapter of ACI. Appears to be general requirement that applies to both working stress and strength design.
2107A - Working Stress Design of Masonry A.1 General. A.1.1 Scope	ACI 530 Chapter 2 – ALLOWABLE STRESS DESIGN OF MASONRY ACI 530 Section 2.1 - General ACI 530 Section 2.1.1 - Scope	Minimal impact
A.1.3 Minimum dimensions for masonry structures located in Seismic Zones 3 and 4.	-	Requirement not found in NFPA/ACI
A.1.5 Embedded anchor bolts	ACI 530 Section 2.1.4 – Anchor Bolts …	Minimal impact
A.1.6 Compression in walls and columns	ACI 530 Section 2.1.9 – Concentrated loads	Minimal impact
A.1.7 Shear walls, design loads	-	Requirement not found in NFPA/ACI
A.1.8 Design, composite construction	ACI 530 Section 2.1.5.2 – Composite action	Comparison of the two sections should be performed to evaluate the need for amendment(s).
A.1.9 Reuse of masonry units	43.6.1 Second hand units	CBC requires using 50 percent of the allowable stress for new units. No reduction in NFPA.
-	ACI 530 Section 2.2 - Unreinforced Masonry	Unreinforced masonry is not allowed under CBC. UBC Section 2107.3 (Design of unreinforced masonry) is not adopted in CBC.
A.2 Design of Reinforced Masonry	ACI 530 Section 2.3 - Reinforced Masonry	-
A.2.1 Scope – requirements for masonry with reinforcement.	ACI 530 Section 2.3.1 Scope – requirements for allowable stress design …	Scope of two codes is similar however a detailed comparison of the two codes should be performed to evaluate the need to amend NFPA/ACI 530.
2108A - Strength Design of Masonry	ACI 530 Chapter 3 – STRENGTH DESIGN OF MASONRY	-
A.1 General A.1.1 General provisions	ACI 530 Section 3.1 – General ACI 530 Section 3.1.1 - Scope	NFPA/ACI includes unreinforced masonry which is not allowed by CBC.
A.2 Reinforced Masonry	ACI 530 Section 3.2 - Reinforced Masonry	-
A.2.1 General	ACI 530 Section 3.2.1 – Scope Masonry design with reinforcement.	Scope of two codes is similar however a detailed comparison of the two codes should be performed to evaluate the need to amend NFPA/ACI 530.
A.2.3 Design of beams, piers and columns	ACI 530 Section 3.2.4.3 - Piers	
A.2.4 Wall design for out-of-plane loads	ACI 530 Section 3.2.5 – Wall design for out-of-plane loads	
A.2.5 Wall design for in-plane loads	ACI 530 Section 3.2.6 – Wall design for in-plane loads	

Chapter 21A - Masonry

2001 CBC - Chapter 21A	NFPA 5000 – Chapter 43	Comments
A.2.6 Design of moment-resisting wall frames	-	No provisions for moment resisting wall frames found in NFPA/ACI.
-	ACI Section 3.3 - Unreinforced (Plain) Masonry	Unreinforced masonry is not allowed under CBC.
-	ACI 530 CHAPTER 4 - PRESTRESSED MASONRY	No provisions for prestressed masonry in CBC.
2109A - Empirical Design of Masonry	ACI 530 CHAPTER 5 - EMPIRICAL DESIGN OF MASONRY	
A.1 General	ACI 530 Section 5.1 – Scope ACI 530 Section 5.1.2 – Limitations	CBC limits use of empirically designed masonry to Seismic Zones 0 and 1 with wind speed less than 80 mph. NFPA/ACI limits use to Seismic Design Categories A and B and 90 mph wind speed (Fastest Mile). Under NFPA/ASCE 7, OSHPD could see buildings falling in Seismic Design Category B which would allow empirical design masonry to be used.
-	ACI 530 CHAPTER 6 - VENEER	CBC requirements for Veneer are in Section 1403A.
2110A - Glass Masonry	ACI 530 CHAPTER 7 – GLASS MASONRY	
A.1 General	7.1 General 7.1.1 Scope	Scope of two codes is similar however a detailed comparison of the two codes should be performed to evaluate the need to amend NFPA/ACI 530. Maximum panel size limit in CBC (Section 2113A.1 item 4) is more restrictive than ACI 530 (Section 7.2)
2112A - Nonbearing Walls	ACI 530 SECTION 1.13.5.2.2 MASONRY PARTITION WALLS, SCREEN WALLS …	CBC amendment language has more specific/detailed requirements.
2113A - Masonry Screen Walls	ACI 530 SECTION 1.13.5.2.2 MASONRY PARTITION WALLS, SCREEN WALLS …	CBC amendment language has more specific/detailed requirements
2114A - Use of Existing Masonry *A.1 General* – limits use. Existing masonry must meet reinforced grouted masonry requirements to be used for structural purpose.	-	No provisions in NFPA chapter 43. There may be some requirements in NFPA Chapter 15.
2115A – Tests and Inspections *A.1* - references 2105A	Chapter 40 – Quality Assurance During Construction	See comparison of CBC Chapter 17A.
Table 21A-A Mortar Proportions for Unit Masonry	ASTM 270-99b - Table 1	ASTM covers mortar types not found in CBC.
Table 21A-B Grout Proportions by Volume	ASTM 476-99 - Table 1	Tables appear to be consistent.
Table 21A-C Grouting Limitations	ACI 530.1 – Table 7	The tables differ and should be compared to determine if amendment is required.
Table 21A-D	ACI 530.1 – Table 1 and Table 2.	The tables differ and should be compared to determine if

2001 CBC - Chapter 21A	NFPA 5000 – Chapter 43	Comments
Specified Compressive Strength of Masonry, *f'm* (psi) Based on Specifying the Compressive Strength of Masonry Units		amendment is required.
Table 21A-E-1 Allowable Tension, *Bt* , for Embedded Anchor Bolts for Clay and Concrete Masonry	-	No Table found in NFPA/ACI
Table 21A-E-2 Allowable Tension, *Bt* , for Embedded Anchor Bolts for Clay and Concrete Masonry	-	No Table found in NFPA/ACI
Table 21A-F Allowable Shear, *Bv*, for Embedded Anchor Bolts for Clay and Concrete Masonry	-	No Table found in NFPA/ACI
Table 21A-G Minimum Diameters of Bend	ACI 530 Table 1.12.6.1	ACI Table includes bend diameter for #3 -#7 bars of grade 40 steel.
Table 21A-H-1 Radius of Gyration for Concrete Masonry Units	-	No Table found in NFPA/ACI
Table 21A-H-2 Radius of Gyration for Clay Masonry Unit Length, 16 Inches	-	No Table found in NFPA/ACI
Table 21A-H-3 Radius of Gyration for Clay Masonry Units Length, 12 Inches	-	No Table found in NFPA/ACI
Table 21A-I Allowable Flexural Tension (psi)	ACI 530 Table 2.2.3.2	The tables differ and should be compared to determine if amendment is required.
Table 21A-J Maximum Nominal Shear Strength Values	ACI 530 Section 3.2.4.1 – Nominal strength. Formulas (3-19) & (3-20)	CBC limits the nominal shear strength, ACI does not appear to have limits. Verify if A_e used in CBC is equivalent to A_n used in ACI.
Table 21A-K Nominal Shear Strength Coefficient - used in section 2108A.2.3.6.2	ACI 530 Section 3.2.4.1 – Nominal strength. Formula (3-21).	This section will require further evaluation to determine if there is a difference between the CBC and ACI. CBC limits the nominal shear strength, ACI does not appear to have limits.
Table 21A-R *Minimum Thickness of Masonry*	ACI 530 Section 5.6 – Thickness of masonry	Cited ACI section is specific to Empirical design of masonry. CBC minimum thickness requirements are general and cited in various CBC sections.

Chapter 22A
Steel
Comparison Summary

Chapter 22 in the *IBC* and Chapter 44 of *NFPA 5000*, cover the design of steel structures.

IBC 2003

IBC covers steel design in the 8 pages of Chapter 22. Structural steel design requirements are found in the AISC reference standards, which are adopted essentially without amendment. Most of the chapter is devoted to design requirements for cold-formed steel structures.

NFPA 5000

NFPA 5000 covers steel design in the 6½ pages of Chapter 44. As with the *IBC*, structural steel design requirements are found in the AISC reference standards, which are adopted without amendment. The balance of the chapter is chiefly devoted to design requirements for cold-formed steel structures.

Summary

The steel design provisions of both model codes are similar.

Chapter 22A - Steel

2001 CBC – Chapter 22A	IBC – Chapter 22	Comments
Division I - General **2201A – Scope** Quality, testing and design of structural steel used in buildings or structures.	**2201 General** 2201.1 Scope.	Similar
2202A - Standards of Quality	**2205 Structural Steel**	No effect
A.1 Material Standards. References UBC Std. 22-1.	Referenced standards: AISC LRFD (1999) - Sec. A.3 AISC 335-89s1 (ASD) - Sec. A.3	Must refer to material Standard (e.g. ASTM A36, 572) for Fy, Ft, etc. IBC does not continue model code org. standards
A.2 Design Standards. ANSI/ASCE 8 Spec. for design of cold-formed stainless steel.	2209.1	Same
A.3 Connectors. ASTM A502, Structural Rivets	AISC LRFD (1999) AISC 335-89s1 (ASD) - Sec. A3.3	Same
2203A - Material Identification	**2003 Identification and Protection of Steel for Structural Purposes**	No effect
A.1 General. Steel either identified or tested.	2203.1 Identification	Same
A.2 Structural Steel. Identification requirements.	2203.1 Identification - general for any structural steel; refer. ASTM	CBC has provision for Fy > 36 ksi and marking steel Review ASTM Standards.
A.3 Cold-formed Steel. Identification requirements.	2203.1 defers to referenced standard - AISI-NASPEC	CBC has provision for Fy > 33 ksi and marking steel Verify ID requirements in AISI-NASPEC.
A.4 Cold-formed Stainless Stl. Identification requirements.	2203.1 defers to referenced standard - ASCE 8	CBC has provision for marking steel Verify ID requirement in ASCE 8.
A.5 Open-web Steel Joists. Identification requirements.	2203.1 defers to referenced standards (SJI, 1994)	CBC has provision for marking at fabrication Verify ID requirements in SJI Specifications.
-	2203.2 Protection	IBC has provision for protection (e.g. paint) of steel
2204A - Design Methods	**2205 Structural Steel**	
A.1 LRFD. References Div. II and IV (AISC LRFD Provisions).	2205.1 References AISC LRFD (1999) and AISC-HSS (2000) - LRFD	IBC ref. current standards, replaces 1993 ed. LRFD, and adoption of AISC-HSS new to code. Review - training, OSHPD support programs
A.2 ASD. References Div. III and V (AISC ASD Provisions).	2205.1 References AISC 335-89s1 (ASD) Supplement No. 1 dated 12-17-01	Review ASD Supplement No. 1 dated 12-17-01 re: training and OSHPD support programs
2205A - Design and	**2205 Structural Steel**	

Chapter 22A - Steel

2001 CBC – Chapter 22A	IBC – Chapter 22	Comments
Construction Provisions		
A.1 General.	2205.1 General	Similar
A.2 Structural Steel Construction. References Div. II & Div. III	2205.1 references AISC LRFD (1999) and AISC 335-89s1 (ASD)	IBC references current AISC standards for LRFD and ASD, also ref. AISC HSS (2000) - new reference
A.3 Seismic Design Provisions for Structural Steel. References Div. IV and Div. V.	2205.2 - ref. AISC 341 Parts I and III for SDC A, B, C; AISC 341 Part 1 for SDC D, E, F 2205.3 Seismic Requirements for Composite Construction	AISC 341-02 is the current seismic design standard (71 pages) - assess re: differences with CBC provisions Review 341-02 for training and OSHPD support program changes. Review IBC Sec. 2205.3 for training, support program
A.4 Cold-formed Steel Construction. References Div. VI and Div. VII. OSHPD amends re: steel deck diaphragm design, weld washers	2209.1 - references AISI-NASPEC (2001)	IBC references current AISI Specification; review continuation of OSHPD amendment; review changes in AISI standard to determine staff training needs
-	2209.2 Composite slabs on steel decks - IBC references ASCE 3.	ASCE 3 is new standard to code, review training needs
A.5 Cold-formed Stainless Steel Construction - ANSI/ASCE 8.	2209.1 - references ASCE 8	Same
-	**2210 Cold-Formed Steel Light-Framed Construction** 2210.1 General - references AISI *Standard for Cold-Formed Steel Framing - General Provisions* 2210.2 Headers - references AISI *Standard for Cold-Formed Steel Framing - Header Design* 2210.3 Trusses - references AISI *Standard for Cold-Formed Steel Framing - Trusses*	IBC adopts new standards not previously codified Review for adoption by OSHPD, training and code support programs
A.6 Design Provisions for Stud Wall Systems. References Div. VIII.	**2211 Cold-Formed Steel Light-Framed Shear Walls**	Substantial change from CBC - see Div. VIII comments Review test methods and data, probably do not adopt gypsum board sheathing assemblies
A.7 Open-web Steel Joists and Joist Girders. References Div. IX. A.7.1 - OSHPD amends re: material tests and verification tests - 2231A	**2206 Steel Joists** 2206.1 - references SJI Specifications (1994 ed.)	Same Study continuation of CBC Sec. A7.1 (OSHPD amendment)

Chapter 22A - Steel

2001 CBC – Chapter 22A	IBC – Chapter 22	Comments
A.8 Steel Storage Racks. References Div. X, with provision for no reduction of "W" for rack located in seismic zone 3 or 4.	**2208 Storage Racks** 2208.1 adopts RMI Specification, and Sec. 9.6.2.9 of ASCE 7 for seismic design.	Refer to Div. X comments IBC references current RMI standard
A.9 Steel Cables. References Div. XI.	**2207 Steel Cable Structures** 2207.1 references ASCE 19	IBC references current standard (1996 ed.); refer to Div. XI comments
A.10 Welding. References Div. II, III, VI, VII, and approved national standards. A.10.1 OSHPD amendment re: AWS D1.1, D1.3 chemical properties A.10.2 OSHPD amendment requiring welded splices to be detailed	2204.1 Welding	Similar Study continuation of OSHPD amendments A.10.1 and A.10.2
A.11 Bolts. References Div. II, III for HS bolts; anchor bolt construction provisions and base plate hole tolerances.	2204.2 Bolting 2204.2.1 Anchor Rods	Similar regarding HSBs, 2003 model code does not contain the CBC provision allowing oversized hole at base plates - review referenced standards for similar provisions.
A.12 Column Base Plate. DSA amendment to 2205A.11 for shear transfer analysis at oversized base plate holes. Not adopted by OSHPD	**-**	-
A.13 Welded Shear Connectors. OSHPD amendment allowing 1/3 of tabulated values for shear studs used other than composite design (e.g. collectors, chords).	**-**	Review ASCE 3. Study continuation of A.13 (OSHPD amendment) in IBC Sec. 2209.2
Division II - Design Standard for LRFD Specification for Structural Steel Buildings **2206A** adopts *LRFD Specification for Structural Steel Buildings*, dated 12-1-93, published by AISC.	2205.1 adopts AISC-LRFD (1999) and AISC-HSS (2000)	AISC-LRFD (1999) is the current edition; CBC adopts 1993 edition. Staff training for LRFD required. AISC-HSS adoption is new to code. Need training in use of HSS standard.
2207A - Amendments adopt appendices B, E, F, G, H, J, K; and defers load combination requirements to Sec. 1612A.2.	**-**	1999 appendices are integral part of Specification (no amendment required).
Division III - Design Standard for Specification for Structural Steel Buildings - ASD and	2205.1 adopts AISC 335 (1989 ASD and Supplement No. 1 dated 12-17-01)	Supplement No. 1, dated 12-17-01 is the current amendment to the 1989 ASD Specification.

Chapter 22A - Steel

2001 CBC – Chapter 22A	IBC – Chapter 22	Comments
Plastic Design **2208A** adopts the *Specification for Structural Steel Buildings Allowable Stress Design and Plastic Design*, dated June 1, 1989, published by AISC. Also adopts App. B5, F7, K4.		Note - AISC is developing the 2005 Standards, which will incorporate both ASD and LRFD into one Specification. Review Supplement No. 1 to determine training needs.
2209A - Amendments 1. Amends A.4 -code loads govern 2. Deletes A4.1, A4.4, A4.5. 3. Amends A5.2, no 1/3 inc. for load comb. 1612A.3.1. 4. Amends J1, 10; OSHPD amendment re: bolts in combination with welds 5. Amends J3, 7; allowable bearing at bolt holes	-	Study continuation of OSHPD amendments (items 4, 5)
Division IV - Seismic Provisions for Structural Steel Buildings **2210A** adopts (per OSHPD amendment) *Seismic Provisions for Structural Steel Buildings*, dated 4-15-97 by AISC, including Supplement No.1, dated 2-15-99. Note - 2002 OSHPD Supplement, adopts AISC Supplement No. 2 to the 97 Seismic Provisions.	2205.2 Seismic Requirements for Steel Structures. Adopts AISC 341-02. For SDC D, E, and F, compliance with 341-02, Part I (LRFD) is required.	IBC adopts current AISC Standard for seismic design. Study IBC 2205.2.1 provisions for SDC A, B, C - provides conditional requirement for use of AISC 341. May amend. Staff training required.
2211A - Amendments Amendments incorporate Supplement No. 1 provisions.	-	IBC provisions current.
Division V - Seismic Provisions for Structural Steel Buildings for Use with ASD Seismic **2212A - General**; refers to load combination per 1612A.3 (ASD) must comply with Div. III and V.	2205.2 Seismic Requirements for Steel Structures. Adopts AISC 341-02, Parts I and III allowed (Part 3 is ASD alternate provision)	Staff training required. ASD methodology uses both Part I and Part III provisions (Part I is LRFD).
2213A - Seismic Provisions for Zones 3 and 4 A.1 General. A.2 Definitions A.3 Symbols and Notations A.4 Materials 4.1 Quality (ASTM Spec.);	See AISC 341-02.	Staff training required. ASD use is limited.

Chapter 22A - Steel

2001 CBC – Chapter 22A	IBC – Chapter 22	Comments
OSHPD amendment re: weld material requirements. 4.2 member strength requirements (OSHPD amend - F_s) A.5 Column Requirements A.6 Ordinary Moment Frame Requirements A.7 Special Moment-resisting Frame Requirements (SMRF) A.8 Requirements for Braced Frames A.9 Requirements for Special Concentrically Braced Frames A.10 Eccentrically Braced Frame (EBF) Requirements A.11 Requirements for Special Truss Moment Frames		
2214A - Seismic Provisions for Zones 1 and 2 (Not adopted by OSHPD).	**-**	No effect
Division VI - LRFD Design Specification for Cold-Formed Steel Structural Members **2215A** adopts *LRFD Specification for Cold-Formed Steel Structural Members*, dated 3-16-91, published by AISI. Deletes Sec. A4.1, A4.2, A4.4, modifies A5.1.4.	**2209 Cold-Formed Steel** 2209.1 adopts AISI-NASPEC (2001 edition per Chapter 35).	IBC references current AISI Specification, substantial revision from CBC-referenced 1991 Specification. Staff training required.
2216A - Amendments Deletes A4.1, A4.2, A4.4; A5.1.4 revised to require code-prescribed loading.	**-**	Study
Division VII - Specification for Design of Cold-Formed Steel Structural Members **2217A** adopts *Specification for Design of Cold-Formed Steel Structural Members*, 1986 (with December 1989 Addendum), published by AISI.	**2209 Cold-Formed Steel** 2209.1 adopts AISI-NASPEC (2001 edition per Chapter 35).	IBC references current AISI Specification, substantial revision from CBC-referenced 1991 Specification. Staff training required.
2218A - Amendments 1. delete A4.1, A4.2. 2. amend A4.4, re: 1612A.3 load 3. revise E.6 (screw design std.)	**-**	Study

Chapter 22A - Steel

2001 CBC – Chapter 22A	IBC – Chapter 22	Comments
Division VIII - Lateral Resistance for Steel Stud Wall Systems **2219A - General** Allows plywood-sheathed walls with steel stud framing to resist wind/seismic loads (OSHPD amends to allow only plywood, not OSB)	**2211 Cold-Formed Steel Light-Framed Shear Walls** Sections 2211.1 through 2211.4	IBC Sec. 2211.1 through 2211.4 are substantial revision from CBC, such as Type I and Type II (perforated) SW. Study required, evaluate test procedures and data to validate adoption of provisions (i.e. gypsum sheathing probably will not be adopted).
2220A - Special Requirements in Seismic Zones 3 and 4 A.1 general A.2 boundary member and anchorage (OSHPD amends re: load) A.3 panel sheathing (OSHPD amends re: plywood only)	2211.4 Seismic Design Categories D, E, F	Evaluate SDC methodology to Zone 3/4; may need to limit healthcare facilities to SDC D, E, F design/construction provisions Evaluate changes from CBC provisions May not adopt provisions for gypsum sheathing
Table 22A-VIII-A Nominal Shear Values - Wind	**Table 2211.2 (1)** Nominal Shear Values - Wind	See above
Table 22A-VIII-B Not adopted by OSHPD	**Table 2211.2 (2)** Nominal Shear Values - Wind (gypsum board)	Gypsum board sheathing Study - do not adopt
Table 22A-VIII-C Nominal Shear Values - Seismic	**Table 2211.1 (3)** Nominal Shear Values - Seismic	See above
	Table 2211.3 Shear Resistance Adjustment Factor - Ca	Study
Division IX- Open Web Steel Joists **2221A** adopts the *Standard Specification for Steel joists, K-series, LH-series, DLH-series and Joist Girders, 1994*, published by the Steel Joist Institute.	**2206 Steel Joists** 2206.1 adopts (1994 ed.): *Standard Specifications for open Web Steel Joist, K Series.* *Standard Specifications for Longspan Steel Joist, LH Series and Deep Longspan Steel Joists, DLH Series.* *Standard Specification for Joist Girders.*	Same
Division X - Design Standard for Steel Storage Racks Based on the *Specification for the Design, Testing and Utilization of Industrial Steel Storage Racks*, 1990 edition, by the Rack Manufacturers Institute.	**2208 Steel Storage Racks** 2208.1 adopts the *RMI Specification for the Design, Testing, and Utilization of Industrial Steel Storage Racks* (1997 edition per Chapter 35).	Study for staff training needs.

Chapter 22A - Steel

2001 CBC – Chapter 22A	IBC – Chapter 22	Comments
2222A – General A.1 scope A.2 definitions A.3 materials A.4 design specifications A.5 integrity of installation **2223A - Design Procedures** **2224A - Allowable Stresses** **2225A - Pallet and Stacker-Rack** **2226A - Frame Design** **2227A - Connections** **2228A - Loads** **2229A - Special Rack Design Provisions**	IBC has provision for seismic design per ASCE 7-02 Sec. 9.6.2.9.	
Division XI - Design Standard for Structural Application of Steel Cables for Buildings **2230A** adopts ASCE Standard 17-95, *Structural Applications of Steel Cables for Buildings*	**2207 Steel Cable Structures** 2207.1 adopts ASCE 19 (1996 ed. Per Chapter 35) 2207.2 amends ASCE 19 re: load factors	Review current adopted standard for changes from previous standard - staff training.
Division XII - Testing and Inspection (OSHPD amendment) **2231A - General Provisions**	**Chapter 17 Structural Tests and Special Inspections** 1704.3 Steel Construction	IBC has substantial differences from CBC, has SDC triggers
A.1 tests of structural steel	2203.1, 1704.3, Table 1704.3	Study OSHPD amendment for continuation
A.2 tests of HS bolts, nuts, washers	1704.3.3.1, Table 1704.3	Study OSHPD amendment for continuation - may need clarification
A.3 tests of end-welded studs	-	Study OSHPD amendment for continuation
A.4 inspection of shop fabrication	1704.2	Study OSHPD amendment for continuation (clarification may be needed)
A.5 inspection of welding	1704.3.1 Welding	Study OSHPD amendment for continuation (AWS cert.)
A.6 inspection of HS bolting	1704.3.3 High-Strength Bolts.	Study OSHPD amendment for continuation (clarification may be needed)
A.7 open-web steel joist and joist girder design verification tests	-	Study OSHPD amendment
A.8 tests of beam-to-column moment connections	See AISC 341-02	Study repeal - appears to be duplicative

Chapter 22A - Steel

2001 CBC – Chapter 22A	NFPA5000 – Chapter 44	Comments
Division I - General **2201A – Scope** Quality, testing and design of structural steel used in buildings or structures.	**44.1 General** 44.1 general scope statement.	Similar
2202A - Standards of Quality	-	No effect - addressed by referenced standards
A.1 Material Standards. References UBC Std. 22-1.	Referenced standards: AISC LRFD (1999) - Sec. A.3 AISC 335-89s1 (ASD) - Sec. A.3	Must refer to material Standard (e.g. ASTM A36, 572) for Fy, Ft, etc. IBC doe not continue model code org. standards
A.2 Design Standards. ANSI/ASCE 8 Spec. for design of cold-formed stainless steel.	44.6.1.2 adopts ASCE 8 (1990 ed.)	Same
A.3 Connectors. ASTM A502, Structural Rivets	AISC LRFD (1999) AISC 335-89s1 (ASD) - Sec. A3.3	Same
2203A - Material Identification	**44.1.2 Identification of Steel for Structures**	No effect
A.1 General. Steel either identified or tested.	44.1.2.1 and 44.1.2.2 - steel either identified or tested per standard	Same
A.2 Structural Steel. Identification requirements.	44.1.2.1 refers to material standard (e.g .ASTM) for requirements	CBC has provision for Fy > 36 ksi and marking steel Review ASTM Standards.
A.3 Cold-formed Steel. Identification requirements.	44.1.2.1 defers to referenced standard - AISI-NASPEC	CBC has provision for Fy > 33 ksi and marking steel Verify ID requirements in AISI-NASPEC.
A.4 Cold-formed Stainless Stl. Identification requirements.	44.1.2.1 defers to referenced standard - ASCE 8	CBC has provision for marking steel Verify ID requirement in ASCE 8.
A.5 Open-web Steel Joists. Identification requirements.	44.1.2.1 defers to referenced standards (SJI, 1994)	CBC has provision for marking at fabrication Verify ID requirements in SJI Specifications.
2204A - Design Methods	**44.2 Structural Steel Construction**	NFPA references current AISC standards
A.1 LRFD. References Div. II and IV (AISC LRFD Provisions).	44.2.1 General. References AISC LRFD (1999) and AISC-HSS (2000) - LRFD	NFPA ref. current standards, replaces 1993 ed. LRFD, and adoption of AISC-HSS new to code. Review - training, OSHPD support programs
A.2 ASD. References Div. III and V (AISC ASD Provisions).	44.2.1 General. References AISC 335-89s1 (ASD) Supplement No. 1 dated 12-17-01	Review ASD Supplement No. 1 dated 12-17-01 re: training and OSHPD support programs
-	44.2.1.2 Web openings - adopts ASCE 23, *Specification*	Review ASCE 23, staff training

Chapter 22A - Steel

2001 CBC – Chapter 22A	NFPA5000 – Chapter 44	Comments
	for Structural Steel Beams with Web Openings	
2205A - Design and Construction Provisions	**44.2 Structural Steel Construction**	NFPA references current AISC standards
A.1 General.	44.2.1 General.	Same
A.2 Structural Steel Construction. References Div. II & Div. III	44.2.1.1 references AISC LRFD (1999) and AISC 335-89s1 (ASD)	NFPA references current AISC standards for LRFD and ASD. Note - does not ref. AISC HSS (2000).
A.3 Seismic Design Provisions for Structural Steel. References Div. IV and Div. V.	44.2.2.2 - ref. AISC 341 Parts I for SDC A, B, C 44.2.3 ref. AISC 341 Part 1 for SDC D, E, F 44.2.4 Seismic Requirements for Composite Construction	AISC 341-02 is the current seismic design standard (71 pages) - assess re: differences with CBC provisions Review 341-02 for training and OSHPD support program changes. Review NFPA Sec. 44.2.2, 44.2.3, and 44.2.4 for training, support program (note - CBC references AISC 1997 Seismic Part II)
A.4 Cold-formed Steel Construction. References Div. VI and Div. VII. OSHPD amends re: steel deck diaphragm design, weld washers	**44.6 Cold-Formed Steel.** 4.6.1.1 adopts AISI-NASPEC (2001 ed., per Ch.2)	NFPA references current AISI Specification; review continuation of OSHPD amendment; review changes in AISI standard to determine staff training needs
A.5 Cold-formed Stainless Steel Construction - ANSI/ASCE 8.	44.6.1.2 - references ASCE 8	Same
-	44.6.2 Composite Slabs on Steel Decks adopts ASCE 3 (1991 ed.)	ASCE 3 is new referenced standard in code
-	**44.7 Cold-Formed Steel Framing** 44.7.1 General - references AISI *Standard for Cold-Formed Steel Framing - General Provisions* 44.7.2 Trusses - references AISI *Standard for Cold-Formed Steel Framing - Trusses* 44.7.3 Headers - references AISI *Standard for Cold-Formed Steel Framing - Header Design* 44.7.4 Prescriptive Framing (1 and 2 story dwellings)	NFPA adopts new standards not previously codified Review for adoption by OSHPD, training and code support programs OSHPD should not adopt 44.7.4 provisions (not intended for healthcare facilities)
A.6 Design Provisions for Stud Wall Systems. References Div. VIII.	**44.8 Cold-Formed Steel Framing Shear Walls**	Substantial change from CBC - see Div. VIII comments Review test methods and data, probably do not adopt gypum board sheathing assemblies
A.7 Open-web Steel Joists and	**44.3 Steel Joists.**	Same - see Div. IX comments

Chapter 22A - Steel

2001 CBC – Chapter 22A	NFPA5000 – Chapter 44	Comments
Joist Girders. References Div. IX. A.7.1 - OSHPD amends re: material tests and verification tests - 2231A	Adopts SJI Specifications (1994 ed.)	Study continuation of CBC Sec. A7.1 (OSHPD amendment)
A.8 Steel Storage Racks. References Div. X, with provision for no reduction of "W" for rack located in seismic zone 3 or 4.	**44.5 Steel Storage Racks.** 44.5.1 adopts RMI Spec.	Refer to Div. X comments NFPA references current RMI standard
A.9 Steel Cables. References Div. XI.	**44.4 Steel Cable Structures** 44.4.1 references ASCE 19	NFPA references current standard (1996 ed.); refer to Div. XI comments
A.10 Welding. References Div. II, III, VI, VII, and approved national standards. A.10.1 OSHPD amendment re: AWS D1.1, D1.3 chemical properties A.10.2 OSHPD amendment requiring welded splices to be detailed	-	Review referenced standard to determine if there is a need for charging language in code Study continuation of OSHPD amendments
A.11 Bolts. References Div. II, III for HS bolts; anchor bolt construction provisions and base plate hole tolerances.	-	Review referenced standard to determine if there is a need for charging language in code, and regarding base plate bolt hole oversize permitted by CBC.
A.12 Column Base Plate. DSA amendment to 2205A.11 for shear transfer analysis at oversized base plate holes. Not adopted by OSHPD	-	-
A.13 Welded Shear Connectors. OSHPD amendment allowing 1/3 of tabulated values for shear studs used other than composite design (e.g. collectors, chords).	-	Review ASCE 3. Study continuation of A.13 (OSHPD amendment) in NFPA.
Division II - Design Standard for LRFD Specification for Structural Steel Buildings **2206A** adopts *LRFD Specification for Structural Steel Buildings*, dated 12-1-93, published by AISC.	44.2.1.1 adopts AISC-LRFD (1999)	AISC-LRFD (1999) is the current edition; CBC adopts 1993 edition. Staff training for LRFD required.
2207A - Amendments adopt appendices B, E, F, G, H, J, K; and defers load	-	1999 appendices are integral part of Specification (no amendment required).

Chapter 22A - Steel

2001 CBC – Chapter 22A	NFPA5000 – Chapter 44	Comments
combination requirements to Sec. 1612A.2.		
Division III - Design Standard for Specification for Structural Steel Buildings - ASD and Plastic Design **2208A** adopts the *Specification for Structural Steel Buildings Allowable Stress Design and Plastic Design*, dated June 1, 1989, published by AISC. Also adopts App. B5, F7, K4.	44.2.1.1 adopts AISC 335 (1989 ASD and Supplement No. 1 dated 12-17-01)	Supplement No. 1, dated 12-17-01 is the current amendment to the 1989 ASD Specification. Note - AISC is developing the 2005 Standards, which will incorporate both ASD and LRFD into one Specification. Review Supplement No. 1 to determine training needs.
2209A - Amendments 1. Amends A.4 -code loads govern 2. Deletes A4.1, A4.4, A4.5. 3. Amends A5.2, no 1/3 inc. for load comb. 1612A.3.1. 4. Amends J1, 10; OSHPD amendment re: bolts in combination with welds 5. Amends J3, 7; allowable bearing at bolt holes	-	Study continuation of OSHPD amendments (items 4, 5)
Division IV - Seismic Provisions for Structural Steel Buildings **2210A** adopts (per OSHPD amendment) *Seismic Provisions for Structural Steel Buildings*, dated 4-15-97 by AISC, including Supplement No.1, dated 2-15-99. Note - 2002 OSHPD Supplement, adopts AISC Supplement No. 2 to the 97 Seismic Provisions.	44.2.2 Seismic Design Categories A, B, C. 44.2.3 Seismic Design Categories D, E, and F. 44.2.4 Seismic Requirements for Composite Construction. Adopts AISC 341-02. For SDC D, E, and F, compliance with 341-02, Part I (LRFD) is required.	NFPA adopts current AISC Standard for seismic design. Study NFPA 44.2.2 provisions for SDC A, B, C - provides conditional requirement for use of AISC 341. May amend. Staff training required.
2211A - Amendments Amendments incorporate Supplement No. 1 provisions.	-	NFPA provisions current.
Division V - Seismic Provisions for Structural Steel Buildings for Use with ASD Seismic **2212A - General**; refers to load combination per 1612A.3 (ASD) must comply with Div. III and V.	44.2.2 Seismic Design Categories A, B, C. 44.2.3 Seismic Design Categories D, E, and F. 44.2.4 Seismic Requirements for Composite Construction. Adopts AISC 341-02. For SDC D, E, and F, compliance with 341-02, Part I	Staff training required. ASD methodology uses both Part I and Part III provisions (Part I is LRFD).

Chapter 22A - Steel

2001 CBC – Chapter 22A	NFPA5000 – Chapter 44	Comments
	(LRFD) is required.	
2213A - Seismic Provisions for Zones 3 and 4 A.1 General. A.2 Definitions A.3 Symbols and Notations A.4 Materials 4.1 Quality (ASTM Spec.); OSHPD amendment re: weld material requirements. 4.2 member strength requirements (OSHPD amend - F_s) A.5 Column Requirements A.6 Ordinary Moment Frame Requirements A.7 Special Moment-resisting Frame Requirements (SMRF) A.8 Requirements for Braced Frames A.9 Requirements for Special Concentrically Braced Frames A.10 Eccentrically Braced Frame (EBF) Requirements A.11 Requirements for Special Truss Moment Frames	See AISC 341-02.	Staff training required, use of ASD limited.
2214A - Seismic Provisions for Zones 1 and 2 (Not adopted by OSHPD).	-	No effect
Division VI - LRFD Design Specification for Cold-Formed Steel Structural Members **2215A** adopts *LRFD Specification for Cold-Formed Steel Structural Members*, dated 3-16-91, published by AISI. Deletes Sec. A4.1, A4.2, A4.4, modifies A5.1.4.	**44.6 Cold-Formed Steel.** 44.6.1.1 adopts AISI-NASPEC (2001 edition per Chapter 2).	NFPA references current AISI Specification, substantial revision from CBC-referenced 1991 Specification. Staff training required.
2216A - Amendments Deletes A4.1, A4.2, A4.4; A5.1.4 revised to require code-prescribed loading.	-	Study
Division VII - Specification for Design of Cold-Formed Steel Structural Members **2217A** adopts *Specification for Design of Cold-Formed Steel*	**44.6 Cold-formed Steel** 44.6.1.1 adopts AISI-NASPEC (2001 edition per Chapter 35).	NFPA references current AISI Specification, substantial revision from CBC-referenced 1991 Specification. Staff training required.

Chapter 22A - Steel

2001 CBC – Chapter 22A	NFPA5000 – Chapter 44	Comments
Structural Members, 1986 (with December 1989 Addendum), published by AISI.		
2218A - Amendments 1. delete A4.1, A4.2. 2. amend A4.4, re: 1612A.3 load 3. revise E.6 (screw design std.)	-	Study
Division VIII - Lateral Resistance for Steel Stud Wall Systems **2219A - General** Allows plywood-sheathed walls with steel stud framing to resist wind/seismic loads (OSHPD amends to allow only plywood, not OSB)	**44.8 Cold-Formed Steel Framing Shear Walls** Sections 44.8.1 through 44.8.3	NFPA Sec. 44.8.1 through 44.8.3 are substantial revision from CBC, such as Type I and Type II (perforated) SW. Study required, evaluate test procedures and data to validate adoption of provisions (i.e. gypsum sheathing probably will not be adopted).
2220A - Special Requirements in Seismic Zones 3 and 4 A.1 general A.2 boundary member and anchorage (OSHPD amends re: load) A.3 panel sheathing (OSHPD amends re: plywood only)	44.8.3 Seismic Design Categories D, E, F	Evaluate SDC methodology to Zone 3/4; may need to limit healthcare facilities to SDC D, E, F design/construction provisions Evaluate changes from CBC provisions May not adopt provisions for gypsum sheathing
Table 22A-VIII-A Nominal Shear Values - Wind	**Table 44.8.1 (a)** Nominal Shear Values - Wind	See above
Table 22A-VIII-B Not adopted by OSHPD	**Table 44.8.1 (b)** Nominal Shear Values - Wind (gypsum board)	Gypsum board sheathing Study - do not adopt
Table 22A-VIII-C Nominal Shear Values - Seismic	**Table 44.8.1 (c)** Nominal Shear Values - Seismic	See above
-	**Table 44.8.2.2.4.1** Shear Resistance Adjustment Factor Ca	NFPA provision not contained in CBC
Division IX- Open Web Steel Joists **2221A** adopts the *Standard Specification for Steel joists, K-series, LH-series, DLH-series and Joist Girders, 1994*, published by the Steel Joist Institute.	**44.3 Steel Joists.** 44.3.1 adopts (1994 ed.): *Standard Specifications for open Web Steel Joist, K Series.* *Standard Specifications for Longspan Steel Joist, LH Series and Deep Longspan Steel Joists, DLH Series.* *Standard Specification for Joist*	Same

Chapter 22A - Steel

2001 CBC – Chapter 22A	NFPA5000 – Chapter 44	Comments
	Girders.	
Division X - Design Standard for Steel Storage Racks Based on the *Specification for the Design, Testing and Utilization of Industrial Steel Storage Racks*, 1990 edition, by the Rack Manufacturers Institute. **2222A - General** A.1 scope A.2 definitions A.3 materials A.4 design specifications A.5 integrity of installation **2223A - Design Procedures** **2224A - Allowable Stresses** **2225A - Pallet and Stacker-Rack** **2226A - Frame Design** **2227A - Connections** **2228A - Loads** **2229A - Special Rack Design Provisions**	**44.5 Steel Storage Racks.** 44.5.1 adopts the *RMI Specification for the Design, Testing, and Utilization of Industrial Steel Storage Racks* (1997 edition per Chapter 35). NFPA has provision (44.5.3) for seismic design per ASCE 7-02 chapter 9.	Study for staff training needs.
Division XI - Design Standard for Structural Application of Steel Cables for Buildings **2230A** adopts ASCE Standard 17-95, *Structural Applications of Steel Cables for Buildings*	**44.4 Steel Cable Structures.** 44.4..1 adopts ASCE 19 (1996 ed. Per Chapter 35) 44.4.2 amends ASCE 19 re: load factors	Review current adopted standard for changes from previous standard - staff training.
Division XII - Testing and Inspection (OSHPD amendment) **2231A - General Provisions**	**Chapter 40 Quality Assurance During Construction** 40.3.10 Steel Construction	NFPA has substantial differences from CBC, has SDC triggers NFPA very general pertaining to special inspections/tests, OSHPD needs to evaluate for amendment
A.1 tests of structural steel	40.3.10, Table 40.3.10 (a)	Study OSHPD amendment for continuation
A.2 tests of HS bolts, nuts, washers	40.3.10, Table 40.3.10 (a)	Study OSHPD amendment for continuation - may need clarification
A.3 tests of end-welded studs	-	Study OSHPD amendment for continuation
A.4 inspection of shop fabrication	40.3.10, Table 40.3.10 (a)	Study OSHPD amendment for continuation (clarification may be needed)
A.5 inspection of welding	40.3.10, Table 40.3.10 (a)	Study OSHPD amendment for continuation (AWS cert.)
A.6 inspection of HS bolting	40.3.10, Table 40.3.10 (a)	Study OSHPD amendment for continuation (clarification may be needed)

Chapter 22A - Steel

2001 CBC – Chapter 22A	NFPA5000 – Chapter 44	Comments
A.7 open-web steel joist and joist girder design verification tests	-	Study OSHPD amendment
A.8 tests of beam-to-column moment connections	See AISC 341-02	Study repeal - appears to be duplicative

Chapter 23A

Wood

Comparison Summary

OSHPD has focused their review on the Allowable Stress Design (ASD) provisions of the model code, since this is the most common method used. The 2001 CBC uses only the NDS and it's Supplement (2 documents), in conjunction with the provisions of CBC Chapter 23A.

IBC 2003

Chapter 23 of the *IBC*, covering wood construction, is 69 pages long. Compared to the 2001 *CBC*, the chapter is better organized, more concise, and very usable. *IBC* Chapter 23 contains requirements for both engineered and conventional construction. While there are several referenced standards referred to in Section 2306 that are not written in strictly enforceable language, they cover seldom-used topics such as plywood curved panels and stressed-skin systems. OSHPD does not believe these references pose a significant problem.

IBC contains provisions for conventional construction that are applicable to wood-frame structures regardless of occupancy.

NFPA 5000

In contrast, the wood design chapter in *NFPA 5000* (Chapter 45) is unenforceable as written. Chapter 45 contains durability provisions, and references to material and design standards, covering 8 pages. *NFPA 5000* adopts the American Forest Products and Paper Association (AF&PA) *Allowable Stress Design (ASD) Manual for Engineered Wood Construction*. The ASD Manual is a multi-part package, and includes 6 separate documents:

- 2001 *NDS and Supplement* (design values)
- *Supplements* (lumber, glue-lam, poles, panels, diaphragms & shear walls)
- *Supplement: Special Design Provisions for Wind and Seismic*
- Two *Guidelines* (I-joists, composites, trusses, metal connectors)

No order of precedence is established among the various volumes. The manual contains fire-safety design provisions that will require a coordinated review with the SFM for adoption.

The *AF&PA ASD Manual*, *Supplements*, and *Guidelines* comprise a guide for design professionals (as stated in the Preface of the Manual) and is not formatted or written as an enforceable standard. The manual volume itself consists of 98 pages. Fully one-fifth of the manual volume consists of "Project Profiles: Case Studies", that have no place in a building code. Another 17 pages are occupied by design examples. A further 20 pages provide "General Information", including shear and moment diagrams for beams that are available in any general structural engineering reference book. The remaining text, while useful as a design guide, is unenforceable. A sample provision for cross-grain tension from Section 3.1 illustrates the style and presentation of the manual:

The designer is advised that use of wood members in applications that induce tension perpendicular to grain stresses should be avoided.

There are additional difficulties with the use of the *AF&PA ASD Manual* as an enforceable document. There are two different sets of requirements for the design of shear walls and diaphragms, one set contained in the *Supplement* and another in the "*2001 Editions Supplement, Special Design Provisions for Wind and Seismic*". There are inconsistencies between the design values in these two documents, and no indication of the extent to which one document takes precedence over the other.

The supplement *Special Design Provisions for Wind and Seismic* is written in enforceable standard format and contains provisions that would, with amendment, be incorporated in the 2004 CBC.

NFPA 5000 does not contain provisions for conventional construction, and references the *"Wood Frame Construction Manual for One- and Two-Family Dwellings"* (WFCM) for one- and two-family dwelling design and construction (the WFCM also contains prescriptive design provisions in both Part 2 and Part 3, with duplication). Additionally, the WFCM is based on *ASCE 7-98*, while *NFPA 5000* references *ASCE 7-02*. The WFCM is strictly limited in applicability to one- and two-family dwelling design, and therefore cannot be extended to cover other occupancies. The lack of conventional construction provisions in NFPA 5000 is a serious deficiency, since they cover fundamental aspects of wood construction, such as vertical offsets, notching and boring of wood members, exterior wall and partition detailing, and a host of other topics.

Summary

Chapter 23 of the *IBC*, covering wood construction, is a comprehensive presentation of wood design, and superior to the wood chapter in the 2001 *CBC*.

The *ASD* manual referenced in *NFPA 5000* is an excellent resource for designers. However, it is not an enforceable code document. It is more in the form of a textbook and guide than a building code. There are other referenced publications in the wood chapter that do not appear to be enforceable, such as the AF&PA *Load and Resistance Factor Design (LRFD) Manual for Engineered Wood Construction* and the Southern Pine Council *Wood Foundations Design & Construction Guide.* If *NFPA 5000* is adopted a new wood Chapter, incorporating references to the NDS and NDS Supplement (which are enforceable standards) will need ti be prepared. This is a very significant effort, since the existing wood provisions in the CBC and IBC are copyrighted, and cannot be transcribed.

Chapter 23A - WOOD

2001 CBC – Chapter 23A	IBC – Chapter 23	Comments
Division I - General Design Requirements **2301A – General** A.1 Scope A.2 Design methods - refers to 1612A.3, 2305A for ASD and conventional light-frame const.	**2301 General** 2301.1 Scope. 2301.2 General design requirements. 2.1 ASD - 2306 2.2 LRFD - 2307 2.3 conventional provisions - 2308	Similar
2202A - Definitions	**2302 Definitions**	Similar Evaluate OSHPD amendment re: definition of "wood structural panel"; may adopt model code definition if justified (e.g. shear wall test data for OSB)
2203A - Standards of Quality 1. Grading rules 2. Glue-laminated timber 3. Preservative treatment 4. Product standards 5. Design standards 6. Fire retardancy 7. Adhesives and glues 8. Design values	**2303 Minimum Standards and Quality** 2303.1 General. 1.1 Lumber 1.2 I-joists (new) 1.3 glu-lam 1.4 wood structural panels 1.5 fiberboard 1.6 hardboard 1.7 particleboard 1.8 preservative-treated wood 1.9 structural composite lumber 3.2 Fire-retardant-treated wood 3.3 Hardwood plywood 3.4 Trusses 3.5 Test standard for joist hangers 3.6 Nails/staples (ASTM F 1667)	IBC 2303 combines CBC Sec. 2303 and 2304 IBC contains additional provisions re: fire-retardant lumber IBC contains additional provisions for trusses (2303.4.1 truss design drawings) Evaluate 2303.1.4 Wood structural panels (see 2302) Evaluate 2303.1.5 Fiberboard for adoption Evaluate 2303.1.6 Hardboard for adoption Evaluate 2303.1.7 Particleboard provision re: 2306.4.3 IBC contains updated provisions to current standards and materials.
2304A - Minimum Quality A.1 Quality and identification A.2 Minimum capacity or grade (OSHPD amends - no end-jointed lumber unless approved) A.3 Timber connectors A.4 Fabrication, installation, manufacture 4.1 General 4.2 Connectors - refers to Div. III 4.3 Glue-lams -supervision of fabrication 4.4 Metal-plate trusses - refers to Div. V, approved agency insp. 4.5 Fire-retardant treated wood at max. 19% m.c., ply at 15%. 4.6 Size of members - net size 4.7 Shrinkage consideration 4.8 OSHPD amendment re: rejection and application of UBC Std. 23-1.	**2303 Minimum Standards and Quality** 2303.1 General. 1.1 Lumber 1.2 I-joists (new) 1.3 glu-lam 1.4 wood structural panels 1.5 fiberboard 1.6 hardboard 1.7 particleboard 1.8 preservative-treated wood 1.9 structural composite lumber 3.2 Fire-retardant-treated wood 3.3 Hardwood plywood 3.4 Trusses 3.5 Test standard for joist hangers 3.6 Nails/staples (ASTM F 1667) Note: 2304A.3 (re: HD galv. nails in PT or FR material) addressed by IBC 2304.9.5 (same provision)	IBC 2303 combines CBC Sec. 2303 and 2304 New provisions re: fire-retardant lumber Evaluate CBC 2304A.8 amendment for continuation - appears to be dated, may discontinue; regardless, it imposes responsibility on inspector that can not be fulfilled (inspectors are generally not qualified lumber graders)

Chapter 23A - WOOD

2001 CBC – Chapter 23A	IBC – Chapter 23	Comments
2305A - Design and Construction Requirements A.1 General	2301.2 General design requirements.	Similar
A.2 Requires compliance with Div. I, and Div. II, Part I.	2301.2.1 (ASD - 2306) 2301.2.2 (LRFD - 2307 ref. std.)	Similar
A.3 Wind/EQ systems for engineered bldg. Per Div. II, Part II	2301.2.1 (ASD) refers to 2305 2301.2.2 (LRFD) refers to 2305	Evaluate adoption of LRFD; note that CBC does not adopt LRFD (2303A, item 5.4 not adopted)
A.4 ASD design/const. Per Div. III	2306	Similar
A.5 Design/const. of conventional light-frame const. per Div. IV.	2301.2.3	Similar
A.6 Connectors per Div. III, Part III	-	No effect
A.7 Metal plate trusses per Div. V	-	No effect
A.8 Glued built-up members with plywood per Div. VI	-	No effect
A.9 Not adopted by OSHPD	-	No effect
A.10 Not adopted by OSHPD	-	No effect
A.11 OSHPD amendment - testing & inspection per Div. IX	-	No effect
Division II - General Requirements **Part I - Requirements Applicable to All Design Methods (2316-2314)** **2306A - Decay and Termite Protection**	**2304 General Construction Requirements**	IBC formatting different, appears to be generally more cohesive. Note – IBC intermingles tables with code text, which is convenient when the table is small, and inconvenient when the table is large (text is disrupted by 1-3 pages of tables).
A.1 Preparation of Bldg Site Reference to Sec. 3302	-	IBC 3304.1
A.2 Wood Support Embedded in Ground PT requirement- ground contact	2304.11.4 Wood in contact with ground or fresh water.	Similar
A.3 Under-floor Clearance 18"/12" clearance and access	2304.11.2.1 Joists, girders and subfloor.	Similar, except provision for access (18" x 24" opening) found in IBC Sec. 1209 (access to unoccupied areas).
A.4 Plates, Sills and Sleepers treated with approved agency stamp (OSHPD amendment - 12" above grade or 6" w/ mow strip; curb at toilet room)	2304.2.3 Sleepers and sills.	IBC does not address sills on masonry/concrete foundation walls – evaluate for amendment to continue 2001 CBC language Continue OSHPD amendment
A.5 Columns and Posts 8" above exposed ground; OSHPD amends - exposed columns	2304.11.2.6 Posts or columns.	Similar Evaluate OSHPD amendment for continuation
A.6 Girders Entering Masonry or Concrete Walls 1/2" clearance at end/side of girder OSHPD amends to include joists & beams, field treatment	2304.11.2.4 Girder ends.	Similar Continue OSHPD amendment

Chapter 23A - WOOD

2001 CBC – Chapter 23A	IBC – Chapter 23	Comments
A.7 Under-floor Ventilation 1/150 floor area cross venting, screening	2304.11.9 Under-floor ventilation refers to 1203.3	Similar
A.8 Wood and Earth Separation 6" clearance unless PT, planters to have 2" air space	2304.11.2.2 Framing. 2304.11.2.5 Wood siding.	Similar
A.9 Wood Supporting Roofs and Floors Decay resistant or PT if exposed	2304.11.4.2 Wood structural members.	Similar
A.10 Moisture Content of Treated Wood Max. 19% m.c. prior to closing in	2303.1.8.2 Moisture content.	Similar IBC provision is in more appropriate Section.
A.11 - not adopted by OSHPD	-	
A.12 Weather Exposure Exposed glue-laminated timber to be PT or decay resistant; plywood also (OSHPD amends)	2304.11.3 Laminated timbers 2304.11.5 Wood structural members	2304.11.5 - IBC has better charging language
A.13 Water Splash WP paper protection if exposed to water splash (tile, plaster)	-	Evaluate need for OSHPD amendment to continue CBC provision
2307A - Wood Supporting Masonry or Concrete Prohibits use of wood to support masonry/concrete DL, with 4 exceptions noted	2304.12 Wood supporting masonry or concrete.	Similar
2308A - Wall Framing Wall framing per Div. IV unless specific design provided/approved Shrinkage analysis if > 2 stories + roof	2304.3 Wall framing. 2304.3.3 Shrinkage.	Similar – requires walls to be framed per conventional provisions unless specific design provided Shrinkage provisions similar
2309A - Floor Framing Reference to Ch. 16A for wall-floor anchorage Reference to Sec. 708 fire blocking and draft stopping	2304.4 Floor and roof framing.	IBC – no ref. to Ch 16A and no ref. to fire block and draft stop provisions (IBC 717) Non-issue
2310A - Exterior Wall Covering		General comment – IBC does not appear to contain prescriptive provisions (and in one location) that previous UBC provided for wood wall coverings.
A.1 General Weather-resistive barrier	1403.2 Weather protection 2304.6 Wall sheathing.	Similar (IBC does not contain reference to applicable Ch 14 provisions)
A.2 Siding Siding materials, fastening	2304.6 Wall sheathing. Table 2304.6	IBC has differences – no provision for fastening, no beveled siding dimensional provisions, no provision for blocking support at vertical siding
A.3 Plywood Exterior application and joint treatment requirements	2304.6.1 Wood structural panel sheathing.	IBC does not contain provision for joint treatment

Chapter 23A - WOOD

2001 CBC – Chapter 23A	IBC – Chapter 23	Comments
A.4 Shingles or Shakes Bldg. Paper, fasteners, weather exposure per Table 23A-II-K	1403.2, 1405.2 Table 1405.2	IBC does not contain provisions for support (stripping), corrosion-resistant fasteners, weather exposure
A.5 Particleboard Exterior application and fastening, joint treatment	2304.6 Table 2304.6	IBC discontinues acceptance of type M-1 particleboard, no provisions for gapping, joint treatment, nail edge distance
A.6 Hardboard Exterior application and fastening, joint treatment	2304.6, 1404.3 (refers to AHA A135.4, 135.6) 1405.2, Table 1405.2	IBC does not contain provisions for edge gap and edge treatment, nailing, lap siding provisions (may be contained in AHA Std. referenced in 1404.3)
A.7 Nailing (corrosion resistant)	Table 2304.9.1 Fastening Schedule (footnote f)	Could not find explicit provision in IBC; only footnote to Table 2304.9.1 as noted. Consider OSHPD amendment to continue CBC A.7
2311A - Interior Paneling softwood structural panels - ref. to Table 23A-II-B-1, UBC Std. 23-3, Chapter 8 (int. finish)	2304.6.2 Interior paneling.	IBC references AHA Std., DOC PS 1 and PS 2. Appears more current than CBC.
2312A - Sheathing A.1 Structural floor sheathing - strength/stiffness (ref. to span table) A.2 Structural roof sheathing - strength/stiffness (ref. to span table)	2304.7.1 Structural floor sheathing. 2304.7.2 Structural roof sheathing.	Similar (IBC does not contain CBC provision for 300# conc. Load)
2313A - Mechanically Laminated Floors and Decks Prescriptive requirements for lumber set on edge	2304.8 Mechanically laminated floors and decks.	Same
2314A - Post-Beam Connections positive connection required	2304.9.7 Framing requirements.	Similar
Part II - Requirements Applicable to Engineered Design of Wind and EQ Load-Resisting Systems **2315A - Wood Shear Walls and Diaphragms**	**2305 General Design Requirements for Lateral-Force Resisting Systems**	IBC 2305 is formatted differently from CBC 2315A, with separated (horizontal) diaphragm provisions from shear wall provisions. 2305.1 contains general provisions, 2305.2 contains diaphragm provisions, and 2305.3 contains shear wall provisions.
A.1 General Deflection consideration, ref. to UBC Std. 23-2 for deflection calc. Aspect ratio ref. to Table 16A-V OSHPD amendment re: test confirmation for analysis method Open-front bldg. limitations	2305.1 General. 2305.2 Design of wood diaphragms. 2305.3 Design of wood shear walls. 2305.3.5 contains open front building provisions	Similar; IBC contains deflection calculation formulas the CBC has in UBC Std. 23-2. Continue OSHPD amendment re: test confirmation
A.2 Wood Members Resisting Horizontal Forces Contributed by Masonry and Concrete OSHPD amendment - wood not allowed to resist continuously applied horizontal force	2305.1.5 Wood members resisting horizontal seismic forces contributed by masonry and concrete.	Evaluate continuation of OSHPD amendment limiting application to one-story buildings, and ½ allowable loads.

2001 CBC – Chapter 23A	IBC – Chapter 23	Comments
A.3 Wood Diaphragms 1. conventional lumber diaph. 2. special lumber diaph. 3. plywood diaph. (OSHPD amend)	2306.3.4 Single diagonally sheathed lumber diaphragms 2306.3.5 Double diag. sheathed lumber diaphragms 2306.4 Shear walls. 2305.2.4 Construction (horizontal diaph. w/ wood structural panels)	2306.3.4 and 3.5 are contained in ASD design provisions in IBC. OSHPD amendments to 2315A.3.3 are extensive, and need evaluation for continuation (some of the amendment provisions may not need continuation)
A.4 Particleboard Diaphragms. OSHPD amends - specific approval required for use	2306.4.3 Particleboard shear walls.	Evaluate for non-adoption
A.5 Wood Shear Walls and Diaphragms in Seismic Zones 3/4 1. scope 2. framing - OSHPD amends re: chord/collector location within 14" 3. wood structural panels - 24" min. width, blocking 4. heavy wood panels - 2x diag. Sheathing; panels overlaying straight sheathed deck 5. not adopted by OSHPD	2305.1.2 Framing. - addresses chords, collector members 2305.2.4 Construction. – addresses wood structural panels	Continue OSHPD amendment Evaluate 2305.3.7 (shear walls with openings) for adoption. May review APA diaphragm test data (as available).
A.6 Not adopted by OSHPD	-	
Table 23A-II-A-1 Exposed Plywood Panel Siding	**Table 2304.6** Minimum Thickness of Wall Sheathing	IBC table addresses various types of sheathing No OSHPD amendment
Table 23A-II-A-2 Allowable Spans for Exposed Particleboard Panel Siding	**Table 2304.6** Minimum Thickness of Wall Sheathing	IBC table addresses various types of sheathing No OSHPD amendment
Table 23A-II-B-1 Nailing Schedule (OSHPD amends)	**Table 2304.9.1** Fastening Schedule	IBC Table incorporates staple option; continue OSHPD amendments and repeal staple option
Table 23A-II-B-2 Wood Structural Panel Roof Sheathing Nailing Schedule (wind)	-	No effect to OSHPD programs
Table 23A-II-C Hardboard Siding	Table 2308.9.3(6) Hardboard Siding	Similar (IBC Table prescribes fastener size, material requirements)
Table 23A-II-D-1 Allowable Spans for Lumber Floor and Roof Sheathing	**Table 2304.7(1)** Allowable Spans for Lumber Floor and Roof Sheathing	Same
Table 23A-II-D-2 Sheathing Lumber Minimum Grade Requirements: Board Grade	**Table 2304.7(2)** Sheathing Lumber Minimum Grade Requirements: Board Grade	Same
Table 23A-II-E-1 Allowable Spans and Loads for Wood Structural Panel Sheathing (perpendicular to supports)	**Table 2304.7(3)** Allowable Spans and Loads for Wood Structural Panel Sheathing (perpendicular to supports)	Same
Table 23A-II-E-2 Allowable Load for Wood	**Table 2304.7(5)** Allowable Load for Wood	Same

2001 CBC – Chapter 23A	IBC – Chapter 23	Comments
Structural Panel Roof Sheathing (parallel to supports)	Structural Panel Roof Sheathing (parallel to supports)	
Table 23A-II-F-1 Allowable Span for Wood Structural Panel Combination Subfloor-Underlayment	**Table 2304.7(4)** Allowable Span for Wood Structural Panel Combination Subfloor-Underlayment	Same
Table 23A-II-F-2 Not adopted by OSHPD	-	No effect to OSHPD programs
Table 23A-II-G Not adopted by OSHPD (OSHPD adopts Table 16A-V, which prescribes diaphragm aspect ratio limits)	**Table 2305.2.3** Maximum Diaphragm Dimension Ratios – Horizontal and Sloped Diaphragm **Table 2305.3.3** Maximum Shear Wall Aspect Ratio	Evaluate amendment of IBC tables per CBC Table 16A-V
-	**Table 2305.3.7.2** Shear Resistance Adjustment Factor C_o	Evaluate for adoption (see IBC Sec. 2305.7 comments)
Table 23A-II-H Allowable Shear for Horizontal Diaphragms (OSHPD amends)	**Table 2306.3.1** Recommended Shear (PLF) for Wood Structural Panel Diaphragms	Similar IBC table includes staple fasteners, is updated to DOC PS 1, PS 2 Evaluate continuation of OSHPD amendments
-	**Table 2306.3.2** Allowable Shear (PLF) for Horizontal Blocked Diaphragms Utilizing Multiple Rows of Fasteners (High Load Diaphragm)	Evaluate for adoption (study test data); this table would be a new provision
-	**2306.3.3** Diagonally Sheathed Lumber Diaphragm Nailing Schedule	IBC puts CBC requirements (Sec. 2315A.3.1) in Table format – can adopt
Table 23A-II-I-1 Allowable Shear for Plywood Shear Walls (OSHPD amends)	**Table 2306.4.1** Allowable Shear (PLF) for Wood Structural Panel Shear Walls	Similar IBC table includes staple fasteners, is updated to DOC PS 1, PS 2 Evaluate continuation of OSHPD amendments
Table 23A-II-I-2 Not adopted by OSHPD	**Table 2306.4.3** Allowable Shear for Particleboard Shear Wall Sheathing	OSHPD can only adopt (particleboard shear walls) upon review and acceptance of approved cyclic test data Do not adopt for 2004 CBC
Table 23A-II-J Not adopted by OSHPD	**Table 2308.9.3(4)** Allowable Shear Values for Wind or Seismic Loading on Vertical Diaphragms of Fiberboard Sheathing Board Construction for type V Construction Only	OSHPD can only adopt (fiberboard shear walls) upon review and acceptance of approved cyclic test data Do not adopt for 2004 CBC
Table 25A-I Not adopted by OSHPD	**Table 2306.4.5** Allowable Shear for Wind or Seismic Forces for Shear Walls of Lath and Plaster or Gypsum Board Wood Framed Wall Assemblies	OSHPD can only adopt (plaster or gypsum board shear walls) upon review and acceptance of approved cyclic test data Do not adopt for 2004 CBC

2001 CBC – Chapter 23A	IBC – Chapter 23	Comments
Table 23A-II-K Wood Shingle and Shake Side Wall Exposures	-	Do not address (via amendment) this omission in 2003 model code
-	**Figure 2305.2.5(1)** Diaphragm Length and Width for Plan View of Open Front Building	Clarifies 2001 CBC Sec. 2315A.1 and IBC 2305.2.5 Adopt, study continuation of amendment to 2315A.1
-	**Figure 2305.2.5(2)** Diaphragm Length and Width for Plan View of Cantilevered Diaphragm	Clarifies 2001 CBC Sec. 2315A.1 and IBC 2305.2.5 Adopt, study continuation of amendment to 2315A.1
Figure 23A-II-1 General Definition of Shear Wall Height to Width Ratio	**Figure 2305.3.4** General Definition of Shear Wall Height, Width and Height-to-Width Ratio	Same
Division III - Design Specification for Allowable Stress Design of Wood Buildings **Part I - Allowable Stress Design of Wood** References ANSI/NfoPA NDS-91 Revised 1991 Edition, and Supplement to the 1991 Edition	**2306 Allowable Stress Design**	IBC references 2001 edition NDS (contains updated standards and new standards for wood structural panels, structural composite lumber, I-joists) Evaluation of new NDS provisions required prior to adoption. IBC does not amend the 2001 ed. NDS (1997 UBC did amend 1991 rev. NDS, and OSHPD further amended)
2316A - Design Specifications A.1 Adoption and Scope Adopts NDS Rev. 1991 Ed., including Appendix F, G, J. Adopts Supplement - Tables 2A, 4A, 4B, 4C, 4D, 4E, 5A, 5B, 5C. OSHPD amends to delete C_r factor (rep stress inc.) from Tables	2306.1 Allowable Stress Design.	IBC 2306.1 references NDS (2001 ed., per chapter 35), and various AITC standards, TPI standard, ASAE standards, and APA design specifications
A.2 Amendments to NDS (model code amends per items 1 - 26; OSHPD further amends per items 1-35)	-	IBC does not amend the NDS; OSHPD will need to evaluate continuation of model code and OSHPD amendments, as 2001 NDS continues many 1991 NDS provisions that were amended in the 2001 CBC (see below).
OSHPD amendments item No: 1. scope amended (enforcement) 3. rep. stress inc. limitation 6. 25% DOL okay if 1 reroof inc. 8. 90% for fasteners if fire retard. 12. notches in sawn lumber 13. notches in glue-laminated 21. provisions for lateral support 22. bridging for roof/floor joists 23. radial tension reinforcement 25. radial tension design 28. glue lam manufacture, m.c. 29. glue lam specs, PT protection 30. bolt at wood to concrete 31. delete 12.2.3 - NDS provision 32. delete 12.3.7 - NDS provision	-	CBC amendments appear useful for enforcement agency use, need to evaluation for continuation: - reduces duplicity - repeals NDS references to non-codified references for design - deletes Appendix B Table for DOL (use tabulated values only, which are amended) - coordinates DOL with Chapter 16 load comb. requirements - glulam beam radial tension design requirements amended - fastener (nail) spacing prescriptive requirements - bolt at concrete allowed to be .5 dbl. shear value for wood member 2x thickness

2001 CBC – Chapter 23A	IBC – Chapter 23	Comments
2303A. item 5.4 (OSHPD does not adopt)	**2307 Load and Resistance Factor Design** Adopts ASCE 16 (1995 ed.)	Evaluate the necessity for OSHPD to review ASCE 16 for adoption. Check with industry, ICC, SEAOC ?? Check whether LRFD provisions address ASD provisions contained in 2306 re: construction requirements
Part II - Plywood Structural Panels **2317A - Plywood Structural Panels** references Table 23A-III-A	-	IBC references DOC PS 1, and does not contain Table 23A-III-A. No amendment needed.
Part III - Fastenings **2318A - Timber Connectors and Fasteners** A.1 General. References Div. III Part I (NDS), or 2318A.	23016.1 - Reference to NDS, see Section 10 and 11	All IBC connection provisions are contained only within the NDS, 2001 ed. There are fastener tables for various configurations (i.e. sideplates, member type/thickness) Also note new provision in NDS for rivets (Section 13). Current OSHPD amendments would need to be continued as amendments to the referenced standard. Staff training for use of NDS will be required.
A.2 Bolts Ref. Tables 23A-III-B-1, B-2. OSHPD amendment re: carriage bolts and cross grain shrinkage	23016.1 - Reference to NDS, see Sections 10 and 11	Evaluate OSHPD amendments for continuation (would be amending the NDS)
A.3 Nails and Spikes 1. allowable loads - ref. Tables 23A-III-C-1 and C2. OSHPD amendment - casing nails/toenails Zone 3/4 limitation - toenail 150 plf 2. Withdrawal values per Table 23A-III-D (OSHPD amends - limits to connection with 4 nails max) 3. spacing and penetration (OSHPD amends - 2 - 2x members nailed and overdriven plywd. Nails) 4. OSHPD amendment - corrosion resistance for exterior siding nails	23016.1 - Reference to NDS, see Sections 10 and 11 Nail withdrawal – see NDS Table 11.2c	Evaluate OSHPD amendments for continuation (amending the NDS) Revise exterior siding nail amendment from 1.5 oz. to 1.0 oz. coating requirement, may place exterior siding corrosion-resistant fastener amendment in 2304.9
A.4 Joist Hangers and Framing Anchors	2304.9.3 Joist Hangers and Framing Anchors.	Similar
A.5 Miscellaneous Fasteners 1. drift bolts/pins 2. spike grids	NDS provisions do not specifically address	No effect, since CBC provisions are general
A.6 (OSHPD amendment) Wood screws and lag screws 1. limitations on withdrawal; washer under head of lag screw	-	Evaluate amendments for continuation (would amend the NDS, Section 11)
A.7 (OSHPD amendment) Metal plate connectors for trusses 1. joint design 2. basic load values 3. inspection 4. truss loads 5. truss drawings 6. moisture content	2303.4 Trusses 2306.1 (refers to TPI 1, 2002 ed)	Evaluate amendments for continuation in TPI 1. Some amendment provisions may be addressed in the 2002 ed. TPI 1.

2001 CBC – Chapter 23A	IBC – Chapter 23	Comments
Part IV - Allowable Stress Design for Wind and EQ Loads **2319A - Wood Shear Walls and Diaphragms** A.1 conventional lumber diaphragms (OSHPD amends to address allowable loads and 2x6 diagonal sheathing w/ 16d nails) A.2 special lumber diaphragms - ref. 2315A.3.2 A.3 plywood diaphragms - ref. to Tables and 2315A.3.3; addresses plywood on both sides of wall	2306.3 Wood diaphragms. 2306.3.2 Wood structural panel diaphragms 2306.3.4 Single diagonally sheathed lumber diaphragms 2306.3.5 Double diagonally sheathed lumber diaphragms 2306.3.6 Gypsum board diaphragm ceilings 2306.4 Shear walls 2305.3.8 Summing shear capacities.	Do not adopt 2306.3.6 Gypsum board ceiling diaphragms
A.4 & A.5 - Not adopted by OSHPD (particleboard and fiberboard sheathing diaphragms)	2306.4.3 Particleboard shear walls 2306.4.4 Fiberboard shear walls	OSHPD can not adopt unless cyclic test data provided, reviewed and accepted.
2513A not adopted by OSHPD	2306.4.5 Shear walls sheathed with other materials (gyp. bd., plaster)	OSHPD can not adopt unless cyclic test data provided, reviewed and accepted.
Table 23A-III-A Allowable Unit Stresses for Construction and Industrial Softwood Plywood	-	IBC references DOC PS 1, and does not contain Table 23A-III-A. No amendment needed.
Table 23A-III-B-1 Bolt Design Values for Single Shear Connections	**NDS Table 11A, 11B, 11C, 11D, 11E** Bolts: Design Values for Single Shear Connections	Similar
Table 23A-III-B-2 Bolt Design Values for Double Shear Connections	**NDS Table 11F, 11G, 11H, 11I** Bolts: Design Values for Double Shear Connections	Similar
Table 23A-III-C-1 Box Nail Design Values for Single Shear Connections	**NDS Table 11N, 11P, 11Q, 11R** Common Wire, Box, Sinker Nails: Design Values for Single Shear	Similar
Table 23A-III-C-2 Common Wire Nail Design Values for Single Shear Connections	**NDS Table 11N, 11P, 11Q, 11R** Common Wire, Box, Sinker Nails: Design Values for Single Shear	Similar
Table 23A-III-D Nail and Spike Withdrawal Design Values	**NDS Table 11.2c** Nail and Spike Withdrawal Design Values	Similar
Division IV – Conventional Light-Frame Construction **2320A - Conventional Light-Frame Construction Design Provisions** A.1 General. (OSHPD amends to denote that conventional provisions are in addition to other requirements of code)	**2308 Conventional Light-Frame Construction** 2308.1 General	Continue OSHPD amendments to the general provisions.

Chapter 23A - WOOD

2001 CBC – Chapter 23A	IBC – Chapter 23	Comments
A.2 - A.5.5 not adopted by OSHPD	2308.2 Limitations 2308.3 Braced wall lines 2308.4 Design of portions	Do not adopt 2308.2, 2308.3, 2308.4
A5.6 Interior Brace Wall Support. foundation requirements	2308.3.4 Braced wall line support	Do not adopt
A.6 Foundation Plates or Sills. OSHPD amends - sill bolt size, spacing, end distance; AB embed sill plate notches; field treatment	2308.6 Foundation plates or sills.	Similar Continue OSHPD amendments. Consider new amendment to address modular construction (no concrete curb)
A.7 Girders.	2308.7 Girders	Similar
A.8 Floor Joists. 1. general (OSHPD amend - design per general provisions, calcs) 2. bearing 3. framing details; notches (OSHPD amend re: ledger strip 2x min) 4. framing around openings 5. supporting bearing walls (OSHPD amend re: built-up beams or blkg) 6. blocking 7. bridging (OSHPD amend)	2308.8 Floor joists 1. bearing 2. framing details 3. framing around openings 4. supporting bearing partitions 5. lateral support 6. structural floor sheathing 7. underfloor ventilation (refers to 1203.3)	Similar Continue OSHPD amendments
A.9 Subflooring. 1. not adopted by OSHPD 2. plywood - ref. tables 3. plank flooring 4. not adopted by OSHPD	2304.7.1 2308.8.6	No effect
A.10 Particleboard Underlayment general req: 1/4" thick, Type PBU	2304.7.1 2308.8.6	No effect
A11 Wall Framing. 1. size, height, spacing 1.1 size (OSHPD amend) 1.2 height (OSHPD amend) 1.3 spacing (OSHPD amend - 16"oc) 2. framing details - OSHPD amend re: opening and bolts at concrete 3. bracing (OSHPD amends - lateral system must be designed) 4. not adopted by OSHPD 5. cripple walls 6. headers 7. pipes in walls 8. not adopted by OSHPD	2308.9 Wall framing. 1. size, height and spacing. 2. framing details 3. bracing 4. cripple walls 5. openings in exterior walls 6. openings in interior bearing walls 7. openings in interior non-bearing walls 8. pipes in walls 9. bridging 10. cutting and notching 11. bored holes	Similar Continue OSHPD amendments

2001 CBC – Chapter 23A	IBC – Chapter 23	Comments
9. cutting and notching (OSHPD amends to require detailing) 10. bored holes (OSHPD amends – max. 1/3 stud width)		
A12 Roof and Ceiling Framing. 1. general (per general provisions) 2. - 6. not adopted by OSHPD 7. purlins (OSHPD amends) 8. blocking (OSHPD amends to ref. bridging req. per 2316A.2 item 22) 9. roof sheathing - ref. to Tables; ext. glue 10. roof planking	2308.10 Roof and ceiling framing 1. wind uplift 2. ceiling joist spans 3. rafter spans 4. ceiling joist and rafter framing (connections, ties, notches, holes, openings) 5. purlins 6. blocking 7. wood trusses 8. roof sheathing 9. roof planking 10. attic ventilation-refer to 1202.2	Similar Continue OSHPD amendments, do not adopt items 1-3
-	2308.11 Additional requirements for conventional construction in SDC B or C. 2308.12 Additional requirements for conventional construction in SDC D or E.	Evaluate IBC provisions for adoption (in part).
A13. Exit Facilities. Zone 3 and 4 positive anchorage to structure, no TN or withdrawal	2308.12.7 Exit facilities	Similar
Tables 23A-IV-A, 23A-IV- B Not adopted by OSHPD	**Tables 2308.10.9, 2308.9.1** Allowable Spans for 2" T & G Size, Height and Spacing - Studs	Do not adopt
Table 23A-IV-C-1 Braced Wall Panels	**Table 2308.9.3(1)** Braced Wall Panels	Similar
Table 23A-IV-C-2 Cripple Wall Bracing	-	No effect
Table 23A-IV-D1 Wood Structural Panel Wall Sheathing	**Table 2308.9.3(3)** Wood Structural Panel Wall Sheathing	Similar
Table 23A-IV-D-2 Not adopted by OSHPD	**Table 2308.9.3(5)** Allowable Spans for Particleboard Wall Sheathing	Do not adopt
Tables 23A-IV-J-1 through Table 23A-IV-V-2 Not adopted by OSHPD	**Tables 2308.8(1), 2308.8(2), …**	Do not adopt
Division V - Design Standard for Metal Plate Connected Wood Truss (Based on ANSI/TPI 1-1995) **2321A - Metal Plate Connected**	2303.4 Trusses. References TPI-1 (2002 ed. Per Chapter 35) 2306.1 Allowable Stress Design References TPI-1 for allowable	Review TPI-1 -2002 to determine if any amendments may be needed.

2001 CBC – Chapter 23A	IBC – Chapter 23	Comments
Wood Truss Design A.1 ref. to ANSI/TPI standard A.2 performance (load test) A.3 not adopted by OSHPD A.4 markings on truss	stress design	
Division VI - Design Standard for Structural Glued Built-Up Members - Plywood Components (Based on Design and Fabrication Specifications of the APA) **2322A through 2327A** (no OSHPD amendments; rarely, if ever, used for school projects)	2306.1 references APA Plywood Design Specification and Supplements 1 – 5.	Similar - no amendment needed (the referenced standards would be very infrequently used).
Division VII Not adopted by OSHPD Sections 2328A through 2333A Tables 23A-VII-J-1 through 23A-VII-R-12	2308.10.2 Ceiling joist spans – Table 2308.10.2(1) and (2) 2308.10.3 Rafter spans – Tables 2308.10.3(1) through (6)	Do not adopt
Division VIII Not adopted by OSHPD Sections 2334A through 2336A Tables 23A-VIII-A through 23A-VIII-D	2308.10.9 Roof Planking.	IBC does not cover scope of CBC provisions (floor decking, beams); no effect for OSHPD Do not adopt
Division IX - Testing and Inspections (OSHPD amendment) **2337A** A.1 Glue-laminated Timber - cont. inspection, ID marking on member A.2 Timber Connectors - cont. inspection, approved inspector A.3 Manufactured Trusses - cont. inspection, approved inspector	-	Evaluate amendments for continuous inspection of glu-lams, this amendment has been petitioned by APA for repeal or change. The OSHPD-AB has also requested review of this amendment to exempt a (simple) defined class of glulams from continuous inspection. The moisture content amendment must also be reviewed as part of this evaluation. OSHPD should also contact Ken Availia with Forest Product Labs.

Chapter 23A - WOOD

2001 CBC – Chapter 23	NFPA 5000 – Chapter 45	Comments
Division I - General Design Requirements **2301A – General** A.1 Scope A.2 Design methods: A2.1 Allowable Stress Design. - refers to 1612A.3 and 2305A. A2.2 Conventional light-frame construction. - refers to 2305A provisions. note- 2305A is a reference to the Divisions (& Parts) for various design and construction provisions	**45.1 Scope** **45.4.1 ASD** – refers to AF&PA ASD, *Allowable Stress Design (ASD) Manual for Engineered Wood Construction, 2001 ed.* **45.4.1.3** References AF&PA *Wood Frame Construction Manual (WFCM) for One and Two Family Dwellings, 2001 ed. (ANSI)* **45.4.2 LRFD** – refers to AF&PA LRFD, *Load and Resistance Design Manual for Engineered Wood Construction, 1996 ed*.	Scope statement is similar.
2202A - Definitions	**45.2 Special Definitions** **Glossary** (ASD Manual for Engineered Wood Construction)` **2.2 Terminology** (2001 edition *Supplement – Wood Structural Panel Shear Wall and Diaphragm*) **2.2 Terminology** (2001 edition Supplement (to ASD Manual) - *Special Design Provisions for Wind and Seismic* **1.3 Definitions** (WFCM)	Similar NFPA5000 definitions are contained in NFPA5000 and in three (3) AF&PA reference documents Review NFPA5000 and AF&PA reference documents for conflicts and completeness
2203A - Standards of Quality 1. Grading rules 2. Glue-laminated timber 3. Preservative treatment 4. Product standards 5. Design standards 6. Fire retardancy 7. Adhesives and glues 8. Design values	**45.5 Criteria** 1. General 2. Lumber identification 3. Determination of sizes 4. End-jointed lumber 5. Prefabricated wood I-joists 6. Glue-laminated lumber 7. Wood structural panels 8. Fiberboard 9. Hardboard products 10. Particleboard 11. Preservative-treated wood 12. Structural composite lumber 13. Hardwood plywood 14. Interior paneling 15. Fire-retardant treated wood 16. Trusses 17. Connectors, nails and staples	Similar 45.5 provisions generally address CBC 2302A and 2304A provisions.
2304A - Minimum Quality	**45.5 Criteria** (see above)	Similar
A.1 Quality and identification	**45.5.1 General**	Similar
A.2 Minimum capacity or grade (OSHPD amends - no end-jointed lumber unless approved)	**NDS 2.2.1 General Requirement** **45.5.4 End-jointed lumber**	Similar (note that provision is in ref. std.) Continue OSHPD amendment re: end-jointed lumber
A.3 Timber connectors	**45.5.17 Connectors, nails and staples**- general reference to standards	Similar

2001 CBC – Chapter 23	NFPA 5000 – Chapter 45	Comments
	45.6.8.6 – corrosion-resistant fasteners in PT and FR lumber	
A.4 Fabrication, installation, manufacture 4.1 General 4.2 Connectors - refers to Div. III 4.3 Glue-lams -supervision of fabrication 4.4 Metal-plate trusses - refers to Div. V, approved agency insp. 4.5 Fire-retardant treated wood at max. 19% m.c., ply at 15%. 4.6 Size of members - net size 4.7 Shrinkage consideration 4.8 OSHPD amendment re: rejection and application of UBC Std. 23-1.	**45.5.1 General** (and referenced standards) **45.5.3 Determination of Sizes** **45.5.1.16 Trusses** **45.5.6 Structural Glue-laminated Timber** **45.5.15 Fire Retardant-treated wood; 45.5.15.4 Moisture Content** **45.6.3 Size of structural members**	Similar Consider amendment re: shrinkage; study (and discontinue?) Evaluate CBC 2304A.8 (OSHPD amendment re: rejection of lumber) for continuation – appears to be dated and imposes responsibility on the inspector that can not be fulfilled (project inspectors are not required to be qualified lumber graders).
2305A - Design and Construction Requirements A.1 General	**45.3 General.** **45.4 Design Requirements.**	Similar
A.2 Requires compliance with Div. I, and Div. II, Part I.	45.6.1 General Construction Requirements	Similar
A.3 Wind/EQ systems for engineered bldg. Per Div. II, Part II	45.4.1.1 references the ASD Manual, which includes the *Supplement: Special Provisions for Wind and Seismic*	Provisions are similar, except that the (NFPA) provisions are contained in an AF&PA document Supplement to the ASD Manual titled *Supplement: Special Design Provisions for Wind and Seismic*. There does not appear to be a complete path of reference to the applicable Supplement. The identified paths of reference to the (NFPA) provisions are: - 45.4.1.1 reference to ASD Manual. - Manual Sec. 9.2 reference to AF&PA *Wood Structural Panel Shear Wall and Diaphragm Supplement* (includes some duplicative information with the *Supplement: Special Provisions for Wind and Seismic.* - No reference found from the *Wood Structural Panel Shear Wall and Diaphragm Supplement* to the *Supplement: Special Provisions for Wind and Seismic.* - ASD Manual Sec. 1.4 has general reference to the *Supplement: Special Design Provisions for Wind and Seismic* Evaluate and amend to provide clear reference to supplement provisions, also need to review supplements for duplication, conflict and to establish precedence. (example – the shear wall tables in each supplement are not the same; one provides shear values for wood panels over gypsum sheathing while the other does not)
A.4 ASD design/const. Per Div. III	**45.4.1 Allowable Stress Design**	NFPA adopts the AF&PA Manual (not the NDS) for ASD. The ASD Manual is a design guideline and a multi-part package (as stated by NF&PA), and includes the following separate documents: - 2001 NDS and Supplement (design values) - Supplements (lumber, glue-lam, poles, panels,

2001 CBC – Chapter 23	NFPA 5000 – Chapter 45	Comments
		diaphragms & shear walls) - Supplement: Special Design Provisions for Wind and Seismic - Guidelines (I-joists, composites, trusses, metal connectors) Use of the AF&PA Manual (includes 6 documents) as an enforcement tool presents complexities compared to 2001 CBC, which uses only the NDS and it's Supplement (2 documents), in conjunction with the CBC.
A.5 Design/const. of conventional light-frame const. per Div. IV.	45.4.1.3	NFPA does not contain provisions for conventional construction, and references the WFCM for 1 & 2 family dwelling design and construction (WFCM does contain prescriptive provisions in both Part 2 and Part 3, with duplication). The CBC provisions for conventional construction are applicable to wood-frame structures regardless of occupancy, while it appears that NFPA's reference documents only provide conventional provisions for 1 & 2 family dwellings. OSHPD will not adopt 45.4.1.3 (reference to WFCM), as that occupancy is not applicable to OSHPD. OSHPD will need to promulgate conventional provisions to continue the current CBC provisions for application to wood frame schools.
A.6 Connectors per Div. III, Part III	**45.6.8 Connectors and Fasteners.**	Similar (NFPA adopts NDS provisions)
A.7 Metal plate trusses per Div. V	**45.5.16 Trusses**	Similar
A.8 Glued built-up members with plywood per Div. VI	-	APA design standards (structural glued built-up members - plywood components) could be adopted by OSHPD; do not appear to be referenced in AF&PA documents or NFPA5000. (note- these provisions are seldom, if ever, used).
A.9 Not adopted by OSHPD	-	No effect
A.10 Not adopted by OSHPD	-	No effect
A.11 OSHPD amendment – testing & inspection per Div. IX	-	Continue amendments (evaluate continuation of continuous inspection requirements for glue-laminated beams, APA has currently petitioned OSHPD to repeal or modify the current amendment)
Division II - General Requirements **Part I - Requirements Applicable to All Design Methods (2316-2314)** **2306A - Decay and Termite Protection**	**45.6 General Construction Requirements.** **45.6.9 Protection Against Decay and Termites.**	Similar; see comments below for any specific differences
A.1 Preparation of Bldg Site Reference to Sec. 3302	36.2.5	Similar
A.2 Wood Support Embedded in Ground PT requirement- ground contact	45.6.9.6.10 45.6.9.6.11	NFPA less restrictive, allows "naturally durable wood" in contact with ground to support buildings (6.10) OSHPD may amend to continue CBC provision

Chapter 23A - WOOD

2001 CBC – Chapter 23	NFPA 5000 – Chapter 45	Comments
A.3 Under-floor Clearance 18"/12" clearance and access	45.6.9.6.3	Similar
A.4 Plates, Sills and Sleepers treated with approved agency stamp (OSHPD amendment - 12" above grade or 6" w/ mow strip; curb at toilet room)	45.6.9.6.5	CBC requires sills that rest on masonry or concrete foundation are to be PT or foundation redwood. Evaluate NFPA provision for amendment to continue CBC requirements, and also continue the OSHPD amendments currently in CBC.
A.5 Columns and Posts 8" above exposed ground; OSHPD amends - exposed columns	45.6.9.6.8	Similar Continue OSHPD amendments
A.6 Girders Entering Masonry or Concrete Walls 1/2" clearance at end/side of girder OSHPD amends to include joists & beams, field treatment	45.6.9.6.6	Similar Continue OSHPD amendments
A.7 Under-floor Ventilation 1/150 floor area cross venting, screening	-	Develop amendment to continue current CBC requirements (which are model code provisions)
A.8 Wood and Earth Separation 6" clearance unless PT, planters to have 2" air space	45.6.9.6.7	Similar
A.9 Wood Supporting Roofs and Floors Decay resistant or PT if exposed	45.6.9.6.12	Similar
A.10 Moisture Content of Treated Wood Max. 19% m.c. prior to closing in	45.5.11.6	Similar
A.11 - not adopted by OSHPD	-	No effect
A.12 Weather Exposure Exposed glue-laminated timber to be PT or decay resistant; plywood also (OSHPD amends)	45.6.9.6.9	Similar
A.13 Water Splash WP paper protection if exposed to water splash (tile, plaster)	-	Develop OSHPD amendment to continue CBC (model code) provision
2307A - Wood Supporting Masonry or Concrete Prohibits use of wood to support masonry/concrete DL, with 4 exceptions noted	**45.6.10 Wood Supporting Masonry or Concrete**	Similar
2308A - Wall Framing Wall framing per Div. IV unless specific design provided/approved Shrinkage analysis if > 2 stories + roof	-	Develop OSHPD amendment to continue (model code) provisions.
2309A - Floor Framing Reference to Ch. 16A for wall-floor	-	No effect

2001 CBC – Chapter 23	NFPA 5000 – Chapter 45	Comments
anchorage Reference to Sec. 708 fire blocking and draft stopping		
2310A - Exterior Wall Covering	**-**	General comment – NFPA5000 does not appear to contain the prescriptive provisions that the CBC contains for wood wall coverings.
A.1 General Weather-resistive barrier	37.3.1 (contained in Chapter 37 – Exterior Wall Construction)	Similar
A.2 Siding Siding materials, fastening	45.6.6.1	NFPA provision refers to NF&PA reference documents
A.3 Plywood Exterior application and joint treatment requirements	45.6.6.2	NFPA provisions are not prescriptive regarding application (e.g. joint treatment)
A.4 Shingles or Shakes Bldg. Paper, fasteners, weather exposure per Table 23A-II-K	**-**	No provisions
A.5 Particleboard Exterior application and fastening, joint treatment	**45.5.10 Particleboard**	NFPA does not contain specific provisions for exterior application, references ANSI standards
A.6 Hardboard Exterior application and fastening, joint treatment	**45.5.9 Hardboard Products**	NFPA references ANSI standards, refers to "manufacturer's recommendations" to installation No prescriptive provisions as contained in CBC
A.7 Nailing (corrosion resistant)	**-**	Develop OSHPD amendment to continue CBC (model code) provision
2311A - Interior Paneling softwood structural panels - ref. to Table 23A-II-B-1, UBC Std. 23-3, Chapter 8 (int. finish)	**45.5.14 Interior Paneling**	Similar
2312A - Sheathing A.1 Structural floor sheathing - reference to span table A.2 Structural roof sheathing – reference to span table	**45.6.7 Floor and Roof Sheathing**	NFPA provisions refer to AF&PA documents No material differences regarding requirements AF&PA ASD Manual Supplement – Wood Structural Panels does not provide one table (similar to CBC Table 23A-II-E-1) to prescribe requirements (e.g. loads, spans, edge support) requirements for floor and roof sheathing
2313A - Mechanically Laminated Floors and Decks prescriptive requirements for lumber set on edge	45.6.5.3	NFPA references AF&PA Wood Construction Data No. 4, *Plank and Beam Framing for Residential Buildings*. No material effect, as 2313A provisions generally not used for school construction.
2314A - Post-Beam Connections	45.6.4.6	Similar
Part II - Requirements Applicable to Engineered Design of Wind and EQ Load-Resisting Systems **2315A - Wood Shear Walls and Diaphragms**	45.4.1.1 references the ASD Manual, which includes the *Supplement: Special Provisions for Wind and Seismic*	Provisions are similar, except that the (NFPA) provisions are contained in an AF&PA supplement to the ASD Manual titled *Supplement: Special Design Provisions for Wind and Seismic*. There does not appear to be a complete path of reference to the applicable Supplement. The identified paths of reference to the (NFPA) provisions are: - 45.4.1.1 reference to ASD Manual.

2001 CBC – Chapter 23	NFPA 5000 – Chapter 45	Comments
		- Manual Sec. 9.2 reference to AF&PA *Wood Structural Panel Shear Wall and Diaphragm Supplement* (includes some duplicative information with the *Supplement: Special Provisions for Wind and Seismic.* - No reference found from the *Wood Structural Panel Shear Wall and Diaphragm Supplement* to the *Supplement: Special Provisions for Wind and Seismic.* - ASD Manual Sec. 1.4 has a general reference to the *Supplement: Special Design Provisions for Wind and Seismic*; no other reference could be identified. Evaluate and develop amendments within NFPA5000 to provide clear reference to Supplement provisions, also need to review the primary Supplement document for duplication, conflict and to establish precedence. Example: shear wall tables in each supplement are not the same. One provides shear values for wood panels over gypsum sheathing while the other does not. May need to amend either Supplement.
A.1 General Deflection consideration, ref. to UBC Std. 23-2 for deflection calc. Aspect ratio ref. to Table 16A-V OSHPD amendment re: test confirmation for analysis method Open-front bldg. limitations	Following provisions are contained in the AF&PA Supplement – *Special Design Provisions for Wind and Seismic*: **4.2.1 Application Requirements** **4.2.2 Deflection** (horizontal diaphragms) **4.2.4 Diaphragm Aspect Ratios** **4.2.5 Horizontal Distribution of Shear** **4.3.2 Deflection** (shear walls) **4.3.4 Shear Wall Aspect Ratios** **4.3.5 Shear Walls with Openings** Following provisions are contained in the AF&PA *ASD Wood Structural Panel Shear Wall and Diaphragm Supplement*: **3.3 Diaphragm Deflection** **4.3 Shear Wall Deflection**	Similar scope of design addressed The two supplements have provisions (both text and tables) that overlap. Deflection analysis formulae are different (but should yield the same result) Careful review for overlap and potential conflict is required. OSHPD would probably not adopt any overlapping provisions contained in the *ASD Wood Structural Panel Shear Wall and Diaphragm Supplement*. Continue OSHPD amendments (amendments to the Supplement would be contained in NFPA5000, which is difficult for users)
A.2 Wood Members Resisting Horizontal Forces Contributed by Masonry and Concrete OSHPD amendment - wood not allowed to resist continuously applied horizontal force	Following provisions are contained in the AF&PA Supplement – *Special Design Provisions for Wind and Seismic*: **4.1.5 Wood Systems Resisting Horizontal Seismic Forces Contributed by Masonry and Concrete**	Similar, continue OSHPD amendments
A.3 Wood Diaphragms 1. conventional lumber diaph. 2. special lumber diaph. 3. plywood diaph. (OSHPD amend)	Following provisions are contained in the AF&PA Supplement – *Special Design Provisions for Wind and Seismic*: **4.2.7 Diaphragm Assemblies**	Similar Review for amendment, do not adopt 4.2.7.4 Continue OSHPD amendments Note- amendments will be contained in NFPA5000, but applicable to referenced standards

2001 CBC – Chapter 23	NFPA 5000 – Chapter 45	Comments
	4.2.7.1 Wood structural panel diaphragms 4.2.7.2 Diaphragms diagonally sheathed with single-layer of lumber 4.2.7.3 Diaphragms diagonally sheathed with double-layer of lumber 4.2.7.4 Diaphragms horizontally sheathed with single-layer of lumber	applicable to referenced standards
A.4 Particleboard Diaphragms. OSHPD amends - specific approval required for use	-	No effect
A.5 Wood Shear Walls and Diaphragms in Seismic Zones 3/4 1. scope 2. framing - OSHPD amends re: chord/collector location within 14" 3. wood structural panels - 24" min. width, blocking 4. heavy wood panels - 2x diag. Sheathing; panels overlaying straight sheathed deck 5. not adopted by OSHPD	Following provisions are contained in the AF&PA Supplement – *Special Design Provisions for Wind and Seismic*: **4.1.6 Toenails** (pertains to SDC D, E, F)	Continue OSHPD amendments; need to determine most appropriate NFPA5000 or reference document sections to locate amendments
A.6 Not adopted by OSHPD	-	No effect
Table 23A-II-A-1 Exposed Plywood Panel Siding	-	Evaluate need for amendment
Table 23A-II-A-2 Allowable Spans for Exposed Particleboard Panel Siding	-	Evaluate need for amendment
Table 23A-II-B-1 Nailing Schedule (OSHPD amends)	**Table 45.6.8.2** General Fastening Schedule	Study Continuation of OSHPD amendments
Table 23A-II-B-2 Wood Structural Panel Roof Sheathing Nailing Schedule (wind)	-	No effect to OSHPD programs
Table 23A-II-C Hardboard Siding	No table identified - see 45.5.9 Hardboard Products	Evaluate references (ANSI/AHA A135.4)
Table 23A-II-D-1 Allowable Spans for Lumber Floor and Roof Sheathing	See AF&PA Supplement – Wood Structural Panels See Tables 5.2, 6.2, 7.1, 7.2, 7.3, 7.4, 7.5	Evaluate AF&PA Supplement provisions, determine if usable as presented, or if a OSHPD amendment Table needed to replicate the CBC Table provisions
Table 23A-II-D-2 Sheathing Lumber Minimum Grade Requirements: Board Grade	-	No effect to OSHPD program

2001 CBC – Chapter 23	NFPA 5000 – Chapter 45	Comments
Table 23A-II-E-1 Allowable Spans and Loads for Wood Structural Panel Sheathing (perpendicular to supports)	See AF&PA Supplement – Wood Structural Panels See Tables 5.2, 6.2, 7.1, 7.2, 7.3, 7.4, 7.5	Evaluate AF&PA Supplement provisions, determine if usable as presented, or if a OSHPD amendment Table needed to replicate the CBC Table provisions
Table 23A-II-E-2 Allowable Load for Wood Structural Panel Roof Sheathing (parallel to supports)	See AF&PA Supplement – Wood Structural Panels See Tables 5.2, 6.2, 7.1, 7.2, 7.3, 7.4, 7.5	Evaluate AF&PA Supplement provisions, determine if usable as presented, or if a OSHPD amendment Table needed to replicate the CBC Table provisions
Table 23A-II-F-1 Allowable Span for Wood Structural Panel Combination Subfloor-Underlayment	See AF&PA Supplement – Wood Structural Panels See Tables 5.2, 6.2, 7.1, 7.2, 7.3, 7.4, 7.5	Evaluate AF&PA Supplement provisions, determine if usable as presented, or if a OSHPD amendment Table needed to replicate the CBC Table provisions
Table 23A-II-F-2 Not adopted by OSHPD	**-**	No effect
Table 23A-II-G Not adopted by OSHPD	**-**	No effect
Table 23A-II-H Allowable Shear for Horizontal Diaphragms (OSHPD amends)	AF&PA Supplement – *Wood Structural Panel Shear Wall and Diaphragm* - Table 3.1A (wind) Table 3.1B (seismic) AF&PA Supplement – *Special Design Provisions for Wind and Seismic* – Table 4.2A (blocked), Table 4.2B (unblocked), Table 4.2C (lumber diaphragms)	Evaluate duplicative provisions; must repeal overlapping provisions and amend the adopted tables to continue OSHPD provisions
Table 23A-II-I-1 Allowable Shear for Plywood Shear Walls (OSHPD amends)	AF&PA Supplement – *Wood Structural Panel Shear Wall and Diaphragm* - Table 4.1A (wind) Table 4.1B (seismic) AF&PA Supplement – *Special Design Provisions for Wind and Seismic* – Table 4.3A (wood-based sheathing), Table 4.3B (gypsum and plaster), Table 4.3C (lumber diaphragms)	Evaluate duplicative provisions; must repeal overlapping provisions and amend the adopted tables to continue OSHPD provisions
Table 23A-II-I-2 Not adopted by OSHPD	**-**	No effect
Table 23A-II-J Not adopted by OSHPD	**-**	No effect
Table 23A-II-K Wood Shingle and Shake Side Wall Exposures	**-**	No effect
Figure 23A-II-1 General Definition of Shear Wall Height to Width Ratio	**-**	Se AF&PA Supplement – *Special Design Provisions for Wind and Seismic* – 4.3.5 Shear Walls with Openings no illustration, no effect to OSHPD program
Division III - Design Specification for Allowable Stress Design of Wood Buildings	**45.4.1 ASD** – refers to AF&PA ASD, *Allowable Stress Design (ASD) Manual for Engineered Wood Construction, 2001 ed.*	NFPA5000 adopts the AF&PA Manual (not the NDS) for ASD. The ASD Manual is a multi-part package (as stated by NF&PA), and includes the following separate documents:

2001 CBC – Chapter 23	NFPA 5000 – Chapter 45	Comments
Part I - Allowable Stress Design of Wood References ANSI/NfoPA NDS-91 Revised 1991 Edition, and Supplement to the 1991 Edition		- 2001 NDS and Supplement (design values) - Supplements (lumber, glue-lam, poles, panels, diaphragms & shear walls) - Supplement: Special Design Provisions for Wind and Seismic - Guidelines (I-joists, composites, trusses, metal connectors) Use of the AF&PA Manual (includes 6 documents) as an enforcement tool presents complexities compared to 2001 CBC, which uses only the NDS and it's Supplement (2 documents), in conjunction with the CBC. The manual contains fire-safety design provisions that will require a coordinated review with the SFM for adoption. The AF&PA ASD Manual, Supplements, and Guidelines comprise a design guide for design professionals (as stated in the Preface of the Manual) and is not formatted and written as an enforceable standard. The supplement *Special Design Provisions for Wind and Seismic* is written in enforceable standard format and contains provisions that must be incorporated in the 2004 CBC. OSHPD will need to amend 45.4.1 to reference the NDS and NDS Supplement (which are enforceable standards), and will need to incorporate certain provisions contained in the AF&PA manual and supplement(s) into the NFPA5000 code.
2316A - Design Specifications A.1 Adoption and Scope Adopts NDS Rev. 1991 Ed., including Appendix F, G, J. Adopts Supplement - Tables 2A, 4A, 4B, 4C, 4D, 4E, 5A, 5B, 5C. OSHPD amends to delete C_r factor (rep stress inc.) from Tables	See above	See above
A.2 Amendments to NDS (model code amends per items 1 - 26; OSHPD further amends per items 1-35)	-	NFPA does not amend the NDS; OSHPD will need to evaluate continuation of CBC amendments (both model code and OSHPD amendments). 2001 NDS continues many 1991 provisions that were amended in the 2001 CBC.
OSHPD amendments item No: 3. rep. stress inc. limitation 6. 25% DOL okay if 1 reroof inc. 8. 90% for fasteners if fire retard. 12. notches in sawn lumber 13. notches in glue-laminated 21. provisions for lateral support 22. bridging for roof/floor joists 23. radial tension reinforcement 25. radial tension design 28. glue lam manufacture, m.c. 29. glue lam specs, PT protection 30. bolt at wood to concrete 31. delete 12.2.3 - NDS provision 32. delete 12.3.7 - NDS provision		CBC amendments appear useful for enforcement agency use, need to evaluation for continuation: - reduces duplicity - repeals NDS references to non-codified references for design - deletes Appendix B Table for DOL (use tabulated values only, which are amended) - coordinates DOL with Chapter 16 load comb. requirements - glulam beam radial tension design requirements amended - fastener (nail) spacing prescriptive requirements - bolt at concrete allowed to be .5 dbl. shear value for

2001 CBC – Chapter 23	NFPA 5000 – Chapter 45	Comments
		wood member 2x thickness
2303A. item 5.4 (OSHPD does not adopt)	**45.4.2 Load and Resistance Factor Design** References AF&PA LRFD, *Load and Resistance Factor Design Manual for Engineered Wood Construction* (1996 ed.)	Evaluate the necessity for OSHPD to review AF&PA LRFD Design Manual and ASCE 16 for adoption. Check with industry, ICC, SEAOC ?? Check whether LRFD provisions address ASD provisions contained in 2306 re: construction requirements
Part II - Plywood Structural Panels **2317A - Plywood Structural Panels** references Table 23A-III-A	AF&PA Supplement – Wood Structural Panels Tables 3.1, 3.1.1, 3.2, 3.2.1, 3.3, 3.3.1, 3.4, 3.4.1, Table 5.2 (Panel Section Properties)	Similar, direct reference to NFPA5000 preferable
Part III - Fastenings **2318A - Timber Connectors and Fasteners** A.1 General. References Div. III Part I (NDS), or 2318A.	45.4.1.1 reference to AF&PA ASD Design Manual	NFPA5000 adopts the AF&PA Manual (not the NDS) for ASD. The ASD Manual is a multi-part package (as stated by NF&PA), and includes the following separate documents: - 2001 NDS and Supplement (design values) - Supplements (lumber, glue-lam, poles, panels, diaphragms & shear walls) - Supplement: Special Design Provisions for Wind and Seismic - Guidelines (I-joists, composites, trusses, metal connectors) Recommend direct adoption in NFPA5000 of NDS and NDS Supplement All NFPA connection provisions are contained only within the NDS, 2001 ed. There are fastener tables for various configurations (i.e. sideplates, member type/thickness) Also note new provision in NDS for rivets (Section 13). Current OSHPD amendments would need to be continued as amendments to the referenced standard. Staff training for use of NDS will be required.
A.2 Bolts Ref. Tables 23A-III-B-1, B-2. OSHPD amendment re: carriage bolts and cross grain shrinkage	NDS Sections 10, 11	Evaluate OSHPD amendments for continuation (would amend the NDS)
A.3 Nails and Spikes 1. allowable loads - ref. Tables 23A-III-C-1 and C2. OSHPD amendment - casing nails/toenails Zone 3/4 limitation - toenail 150 plf 2. Withdrawal values per Table 23A-III-D (OSHPD amends - limits to connection with 4 nails max) 3. spacing and penetration (OSHPD amends - 2 - 2x members nailed and overdriven plywd. Nails) 4. OSHPD amendment - corrosion resistance for exterior siding nails	NDS Sections 10, 11	Evaluate OSHPD amendments for continuation (amend the NDS) Revise exterior siding nail amendment from 1.5 oz to 1.0 oz coating, may place amendment in 45.5.17

2001 CBC – Chapter 23	NFPA 5000 – Chapter 45	Comments
A.4 structural hardware - general	45.5.17.1 – references ASTM D 1761	Review ASTM D 1761
A.5 Misc. Fasteners 1. drift bolts/pins 2. spike grids	NDS provisions do not specifically address	No effect, since CBC provisions are general
A.6 (OSHPD amendment) Wood screws and lag screws 1. limitations on withdrawal; washer under head of lag screw	-	Evaluate amendments for continuation (would amend NDS, Section 11)
A.7 (OSHPD amendment) Metal plate connectors for trusses 1. joint design 2. basic load values 3. inspection 4. truss loads 5. truss drawings 6. moisture content	**45.5.16 Trusses** refers to ANSI/TPI 1, 1995 ed.	Evaluate amendments for continuation in TPI 1
Part IV - Allowable Stress Design for Wind and EQ Loads **2319A - Wood Shear Walls and Diaphragms** A.1 conventional lumber diaphragms (OSHPD amends to address allowable loads and 2x6 diagonal sheathing w/ 16d nails) A.2 special lumber diaphragms - ref. 2315A.3.2 A.3 plywood diaphragms - ref. to Tables and 2315A.3.3; addresses plywood on both sides of wall	AF&PA Supplement – *Special Design Provisions for Wind and Seismic*	Need direct reference from NFPA5000 to this document
A.4 & A.5 - Not adopted by OSHPD	-	
Table 23A-III-A Allowable Unit Stresses for Construction and Industrial Softwood Plywood	AF&PA Supplement – Wood Structural Panels Tables 3.1, 3.1.1, 3.2, 3.2.1, 3.3, 3.3.1, 3.4, 3.4.1, Table 5.2 (Panel Section Properties)	More complicated than CBC provisions Direct reference from NFPA5000 desirable
Table 23A-III-B-1 Bolt Design Values for Single Shear Connections	**NDS Table 11A, 11B, 11C, 11D, 11E** Bolts: Design Values for Single Shear Connections	Similar, need direct reference from NFPA5000
Table 23A-III-B-2 Bolt Design Values for Double Shear Connections	**NDS Table 11F, 11G, 11H, 11I** Bolts: Design Values for Double Shear Connections	Similar, need direct reference from NFPA5000
Table 23A-III-C-1 Box Nail Design Values for Single Shear Connections	**NDS Table 11N, 11P, 11Q, 11R** Common Wire, Box, Sinker Nails: Design Values for Single Shear	Similar, need direct reference from NFPA5000

2001 CBC – Chapter 23	NFPA 5000 – Chapter 45	Comments
Table 23A-III-C-2 Common Wire Nail Design Values for Single Shear Connections	**NDS Table 11N, 11P, 11Q, 11R** Common Wire, Box, Sinker Nails: Design Values for Single Shear	Similar, need direct reference from NFPA5000
Table 23A-III-D Nail and Spike Withdrawal Design Values	**NDS Table 11.2c** Nail and Spike Withdrawal Design Values	Similar, need direct reference from NFPA5000
Division IV - Conventional Light-Frame Construction **2320A - Conventional Light-Frame Construction Design Provisions** A.1 General. (OSHPD amends to state "in addition to other reqmts")	-	NFPA5000 does not contain provisions for conventional construction, and references the WFCM for 1 & 2 family dwelling design and construction (WFCM does contain prescriptive provisions in both Part 2 and Part 3, with duplication). The WFCM is based on ASCE 7-98 (NFPA5000 references ASCE 7-02). The CBC provisions for conventional construction are applicable to wood-frame structures regardless of occupancy, while it appears that NFPA's reference documents provides conventional provisions for 1 & 2 family dwellings only. OSHPD will not adopt 45.4.1.3 (reference to WFCM), as that occupancy is not applicable to OSHPD's programs. OSHPD will need to promulgate conventional provisions to continue the current CBC provisions for application to wood frame schools.
A.2 - A.5.5 not adopted by OSHPD	-	Develop amendments to NFPA5000
A5.6 Interior Brace Wall Support. Foundation requirements	-	Develop amendments to NFPA5000
A.6 Foundation Plates or Sills. OSHPD amends - sill bolts size/spacing/end distance; AB embed at curd; AB at sill plate notches; field treatment	-	Develop amendments to NFPA5000
A.7 Girders.	-	Develop amendments to NFPA5000
A.8 Floor Joists. 1. general (OSHPD amend – design per general provisions, calcs) 2. bearing 3. framing details; notches (OSHPD amend re: ledger strip 2x min) 4. framing around openings 5. supporting bearing walls (OSHPD amend re: built-up beams or blkg) 6. blocking 7. bridging (OSHPD amend)	-	Develop amendments to NFPA5000
A.9 Subflooring. 1. not adopted by OSHPD 2. plywood - ref. tables	-	Develop amendments to NFPA5000

2001 CBC – Chapter 23	NFPA 5000 – Chapter 45	Comments
3. plank flooring 4. not adopted by OSHPD		
A.10 Particleboard Underlayment general req: 1/4" thick, Type PBU	-	Develop amendments to NFPA5000
A11 Wall Framing. 1. size, height, spacing 1.1 size (OSHPD amend) 1.2 height (OSHPD amend) 1.3 spacing (OSHPD amend – 16"oc) 2. framing details – OSHPD amend re: opening and bolts at concrete or masonry wall) 3. bracing (OSHPD amends – lateral system must be designed) 4. not adopted by OSHPD 5. cripple walls 6. headers 7. pipes in walls 8. not adopted by OSHPD 9. cutting and notching (OSHPD amends to require detailing) 10. bored holes (OSHPD amends – max. 1/3 stud width)	-	Develop amendments to NFPA5000
A12 Roof and Ceiling Framing. 1. general (per general provisions) 2. - 6. not adopted by OSHPD 7. purlins (OSHPD amends) 8. blocking (OSHPD amends to ref. bridging req. per 2316A.2 item 22) 9. roof sheathing - ref. to Tables; ext. glue 10. roof planking	-	Develop amendments to NFPA5000
A13. Exit Facilities. Zone 3 and 4 positive anchorage to structure, no TN or withdrawal	-	Evaluate to determine if amendment needed to continue provision in 2004 CBC
Tables 23A-IV-A, 23A-IV- B Not adopted by OSHPD	-	
Table 23A-IV-C-1 Braced Wall Panels	-	Evaluate to determine if amendment needed
Table 23A-IV-C-2 Cripple Wall Bracing	-	Evaluate to determine if amendment needed
Table 23A-IV-D1 Wood Structural Panel Wall Sheathing	-	Evaluate to determine if amendment needed

2001 CBC – Chapter 23	NFPA 5000 – Chapter 45	Comments
Table 23A-IV-D-2 Not adopted by OSHPD	-	
Tables 23A-IV-J-1 through Table 23A-IV-V-2 Not adopted by OSHPD	-	
Division V - Design Standard for Metal Plate Connected Wood Truss (Based on ANSI/TPI 1-1995) **2321A - Metal Plate Connected Wood Truss Design** A.1 ref. to ANSI/TPI standard A.2 performance (load test) A.3 not adopted by OSHPD A.4 markings on truss	**45.5.16 Trusses** refers to ANSI/TPI 1, 1995 ed.	Evaluate amendments for continuation in TPI 1
Division VI – Design Standard for Structural Glued Built-Up Members – Plywood Components (Based on Design and Fabrication Specifications of the APA) **2322A through 2327A** (no OSHPD amendments; rarely, if ever, used for school projects)	-	Determine if amendment needed to adopt APA Plywood Design Specification and Supplements 1-5
Division VII Not adopted by OSHPD Sections 2328A through 2333A Tables 23A-VII-J-1 through 23A-VII-R-12	-	
Division VIII Not adopted by OSHPD Sections 2334A through 2336A Tables 23A-VIII-A through 23A-VIII-D	-	
Division IX - Testing and Inspections (OSHPD amendment) **2337A** A.1 Glue-laminated Timber - cont. inspection, ID marking on member A.2 Timber Connectors - cont. inspection, approved inspector A.3 Manufactured Trusses - cont. inspection, approved inspector	-	Evaluate amendments for continuous inspection of glu-lams, this amendment has been petitioned by APA for repeal or change. The OSHPD-AB has also requested review of this amendment to exempt a (simple) defined class of glulams from continuous inspection. The moisture content amendment must also be reviewed as part of this evaluation. OSHPD should also contact Ken Avialia with Forest Product Labs.